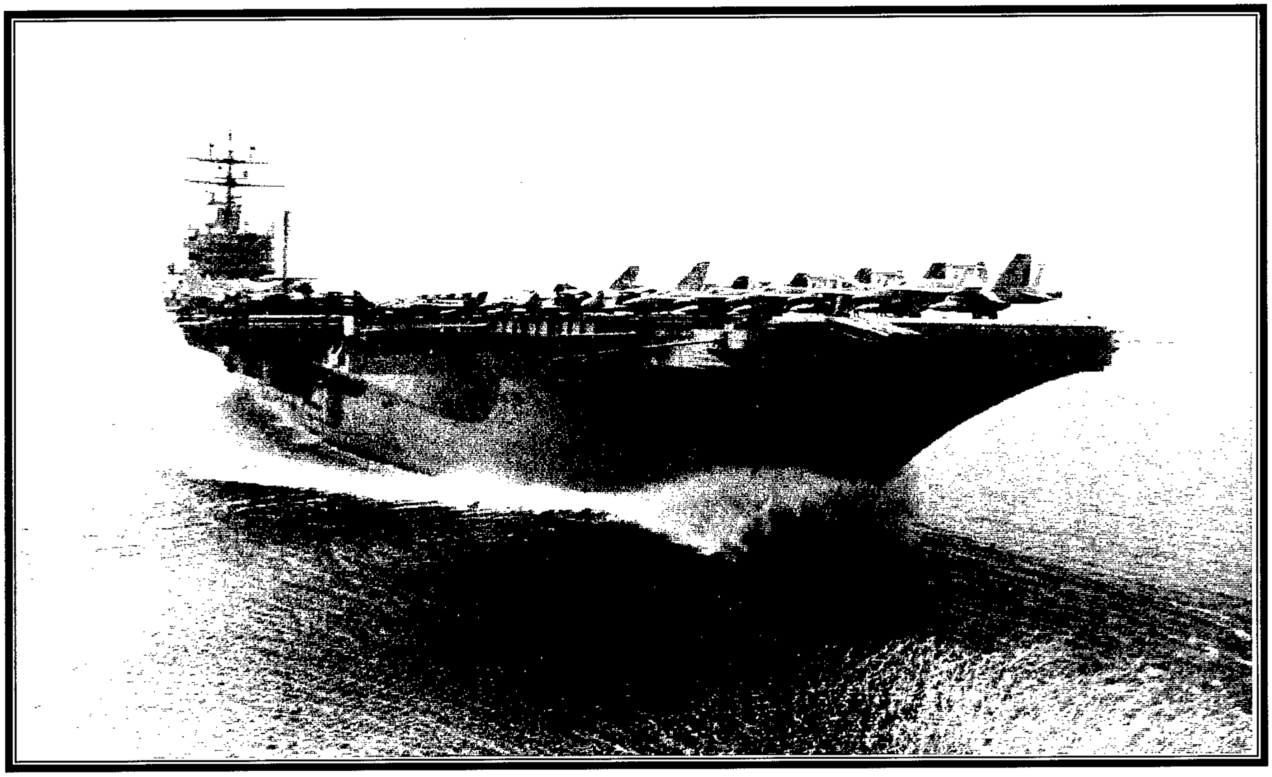
Final Environmental Impact Statement for

Developing Home Port Facilities for Three NIMITZ-Class Aircraft Carriers in Support of the U.S. Pacific Fleet

Coronado, California • Bremerton, Washington
Everett, Washington • Pearl Harbor, Hawaii



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VOLUME 6

Pearl Harbor Naval Shipyard Supplemental Information

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SUMMARY OF NEW FACILITIES REQUIRED AT PEARL HARBOR

Piers B2/3

Equipment/Supporting Items

Bollards, camels, various piping, hoses, and fittings required to connect the CVN to support services.

Drydock #4

Electrical upgrades, telephone lines.

Utility Upgrades

Shore Power

New substation, install permanent 11.5/4.16 kV substation at B-2/3 area including two primary (11.5 kV) circuits, underground duct lines and manholes

Steam

Upgrades to existing steam distribution lines

Sanitary Sewer

Upgrades to existing utility

Telephone

Install 100-line trunk cable

Operational Support Area

Parking

Shipyard has approximately 1,200 unused parking spaces located in various lots (D, A, Night Shift, C, C-annex, H). Shuttle bus transportation is provided during regular working hours.

The CVN would generate a parking requirement of 2,500 parking stalls. An alternative that the Navy would consider is construction of a parking structure and additional surface parking spaces.

Laydown Area

Buildings 92, 391, 292, 1577, 1445, and 1683 would be demolished and the area repaved for laydown space. Building functions would be relocated as part of the shipyard's internal consolidation program.

CIA Fence

The current CIA fence will be relocated as part of the shipyard's internal consolidation program. The realignment will allow entry and exit of ship's personnel without traversing designated CIA boundaries.

Warehouse Space

Buildings 393 and 394 (approximately 200,000 square feet) would meet CVN requirements. No major refurbishment of the buildings would be required.

Controlled Industrial Facility (CIF)

A 48,000 square foot structure used for the inspection, modification, and repair of radiologically controlled equipment and components associated with the Naval nuclear propulsion plants would be constructed. Buildings 4, 4A, 5, 5A, and 8 in the shipyard would be demolished to make room for the CIF. Existing building functions would be relocated as part of the shipyard's internal consolidation program.

SECTION 6.3

MARINE BIOLOGY AND WATER QUALITY ASSESSMENT OF SELECTED SITES IN PEARL HARBOR

MARINE BIOLOGY AND WATER QUALITY ASSESSMENT OF SELECTED SITES IN PEARL HARBOR, HAWAII

In Support of

ENVIRONMENTAL IMPACT STATEMENT FOR AIRCRAFT CARRIER HOMEPORTING WITHIN PACIFIC FLEET'S UNITED STATES ASSETS

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1.0 PURPOSE

An Environmental Impact Statement (EIS) is currently in preparation to evaluate the potential effects of homeporting an aircraft carrier in Pearl Harbor, Oahu, Hawaii. The location of the potential berthing site of the carrier is Piers B2/3 located in East Loch. These piers are presently part of the Pearl Harbor shipyard and are used for berthing of transient vessels. In order for the aircraft carrier to safely enter and exit the harbor, dredging of the Pearl Harbor entrance channel, the turning basin off the eastern side of Ford Island, and the area off Piers B2/3 to a depth of 50+ feet would be required. In order to fully address the potential impacts of the proposed action it is necessary to conduct a field program to evaluate the present marine environmental setting. With such a baseline of existing conditions, it will be possible to evaluate the potential effects of the proposed homeporting. The purpose of this report is to present the results of an assessment of the bottom communities (invertebrates, fish, and marine plants) and water quality at selected, representative sites.

2.0. SURVEY TEAM

The survey team was headed by Dr. Steven Dollar of Marine Research Consultants. Dr. Dollar was responsible for planning of all surveys, execution of all fieldwork, and preparation of all report documents. Drs. Richard Brock and Julie Brock performed analysis of benthic infauna. All water quality analyses were performed in the laboratory of Marine Analytical Specialists in Honolulu, HI. Marine Analytical Specialists possesses all appropriate certifications by the U.S. Environmental Protection Agency (EPA) to perform the required analyses (EPA Lab certification NO. HI00009).

3.0. WATER QUALITY ASSESSMENT

3.1 METHODS

3.1.1 SAMPLING SITES

Ten sites in the Pearl Harbor entrance channel, off Piers B2/3 and in the turning basin were selected by Belt Collins for sediment coring to evaluate the effects of dredging. The sediment coring is being addressed as part of a separate study performed by Belt Collins under contract with SAIC. In order to maintain consistency between that and the present study, water quality sampling stations and biotic community assessment

stations were located at the same ten sites. These sites were located by latitude and longitude recorded by GPS positioning during sediment sampling (Figure 1).

3.1.2. MONITORING CONSTITUENTS

Chemical composition of marine waters in Pearl Harbor was evaluated by analysis of all constituents specified by State of Hawaii, Department of Health water quality standards for embayments (Chapter 11-54-06): total nitrogen (TN), nitrate + nitrite nitrogen ($NO_3^- + NO_2^-$), ammonium (NH_4^+), total phosphorus (TP), turbidity, chlorophyll a, dissolved oxygen, temperature, and pH. Several additional constituents were also measured to characterize water quality: orthophosphate phosphorus (PO_4^{-3}), dissolved silica (Si), total suspended solids (TSS), and salinity.

3.1.3. SAMPLING PROTOCOL

Water sampling was conducted twice; once on September 16, 1997 during a period of relatively dry weather, and once on October 9, 1997. The September survey was conducted following a prolonged period (several weeks) of dry weather, and during a period of no ship traffic in the harbor. The October survey was conducted approximately 24 hours after a period of moderate rainfall, and during a period when ship traffic was transiting the harbor channel. At each survey site 3 samples were collected; one within the upper 25 cm of the water column, one at the mid-point of the water column, and one within 1 m of the Harbor floor (total of 30 samples). Water samples were collected from a small (7 m) boat using 1.8-liter Niskin oceanographic sampling bottles. These bottles contain spring-loaded end-caps which are cocked in an open position allowing free flow-through as the bottle is lowered to the desired sampling depth. At the desired depth, a weighted messenger is released from the surface which trips the end-caps to close, isolating a volume of water. Following collection, samples were transferred from the Niskin bottles to triple-rinsed 1-liter polyethylene bottles and stored on ice until return to the laboratory. *In-situ* field measurements included dissolved oxygen and water temperature using a YSI Model 58 field meter with precision of 0.01 milligrams per liter (mg/l) and 0.1°C., respectively. Measurements for pH were determined in the field with a Hahn Instruments Model 9025 millivolt meter with a precision of 0.01 pH units.

In addition to discrete water samples, continuous profiles of salinity, temperature, and turbidity were acquired at each station using a Ocean Sensors Model 100 CTD.

3.1.4. - LABORATORY ANALYTICAL METHODOLOGY

All water samples were delivered to the laboratory within 4 hours of collection and were analyzed within 48 hours of delivery. Analysis for inorganic nutrients was conducted using automated techniques on a Technicon II autoanalyzer. TN and TP were analyzed in a similar fashion following oxidative digestion. All nutrient procedures were performed according to standard methods for seawater analysis (Strickland and Parsons 1968). Turbidity was determined using a Turner Designs laboratory nephelometer. TSS was determined gravimetrically after filtered samples are dried to constant weight using a Mettler electrobalance. Salinity was determined using an AGE Instruments Model 2100 laboratory salinometer with a precision of 0.0001‰. Chl a was measured with a Hach 3000 spectrophotometer.

3.1.5. FIELD AND LABORATORY QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

3.1.5.1. - Laboratory Certification

The analytical laboratory, Marine Analytical Specialist, possesses current "acceptable" ratings in the USEPA Water Quality Performance Evaluation Study (WPO-26) conducted in conjunction with the State of Hawaii Department of Health. Such certification indicates that the laboratory is practicing acceptable procedures regarding the use of standards, laboratory blanks, duplicates, and spiked samples for calibration and identification of potential interferences which might compromise accuracy and precision.

3.1.5.2. - Instrument calibration

Field instruments were calibrated in the field prior to use as recommended by the manufacturer. YSI oxygen probes were calibrated at 100% saturation; pH probes were calibrated using a two point buffer calibration (7 and 10). Autoanalyzer analytical precision and reproducibility was determined on every run using duplicate sea water blanks and triplicate standards. The AGE salinometer was calibrated using IAPSO Copenhagen sea water standards. The Turner Designs nephelometer was calibrated using EPA formazin turbidity standards. The Hach spectrophotometer was calibrated with Sigma Chl a standards.

3.1.5.3. - Trip blanks

Each time a group of bottles was prepared for use in the field, pairs of bottles of each type were selected from the batch and filled with filtered seawater. One pair of the bottles remained in the laboratory, and one bottle was transported to the sampling location and returned to the laboratory in the identical manner as used for the samples. Trip blank bottle pairs were subjected to the same analyses as the sample water. Variation, if any, in concentrations between bottle pairs of more than could be attributed to (1) interaction between the blank sample water and the container, and/or (2) a handling procedure that altered the sample analysis results. Protocols for the study were as follows: the concentration levels of any contaminants found in the trip blank were not used to correct sample data. Rather, contaminant levels would be noted and compared to field sample results. If the variation of field blanks was not at least an order below the magnitude of field sample results, field sample results would be discarded and resampling conducted. Results of trip blank analysis showed no variation of more than 10%.

3.1.5.4. - Laboratory Quality Control

Duplicate samples were taken at random from field sampling sites and returned to the laboratory. Such duplicates were labeled in a blind manner such that it was not apparent to the analyst which samples were duplicates. Data from duplicate QC replicates were used as a measure of performance of the laboratory analyses, and as a indicator of potential cross- contamination, but were not be used to alter or correct analytical data. Because every chemical constituent has a different level of precision associated with the analysis, it is not possible to specify a general limit of acceptability of precision of blind duplicates. Therefore each constituent was evaluated separately in terms of acceptable laboratory precision as determined from blind replicates.

3.2. RESULTS OF WATER CHEMISTRY ANALYSES

3.2.1. Vertical and Horizontal Stratification

Tables 1 and 2 show results of all water chemistry analyses for samples collected in Pearl Harbor on September 16, 1997, While Tables 3 and 4 show similar results collected on October 9, 1997. For applicable constituents, Tables 1 and 3 show concentrations of nutrients in micromolar units (μM), while Tables 2 and 4 show the

same data in units of micrograms per liter (μg/L). Also shown in Tables 1-4 are the concentrations of State of Hawaii Department of Health water quality criteria for the Pearl Harbor estuary. Figures 2-13 show bar graphs of water quality constituents measured at the 10 sampling stations on September 16, 1997, while figures 17-28 show bar graphs for the results of the October 9, 1997 sampling. In each figure the top graph shows surface concentrations, the middle graph shows concentrations at mid-depth in the water column, and the bottom graph shows concentrations near the harbor floor.

Several trends are apparent in the water chemistry data. At all stations salinity increases with depth, with a distinct surface layer of lower salinity water overlying higher salinity water (Figures 2 and 17). Salinity of the surface layer was lower at all stations during the October sampling compared to the September sampling. However, salinity of water near the bottom was higher at all but one station in the October sampling compared to September. As a result, the vertical gradients of salinity throughout the harbor were steeper in October than in September. Salinity at the inshore stations near potential berthing site at Piers B2/B3 (Stations 1 and 2) was similar to values in mid-channel during both surveys. Vertical stratification of waters in the Pearl Harbor channels is a consistent feature of the estuary, occurring as a result of freshwater input from streamflow and groundwater efflux that persists as a surface layer as water flows out of the harbor to the ocean. The difference in stratification between the two surveys most likely reflects rainfall that occurred prior to the October 9, 1997 sampling.

Dissolved Si mirrors salinity, with highest values in all surface samples, and decreasing concentrations with depth. As Si is present in high concentrations in surface water and groundwater compared to ocean water, the pattern of high Si in the low salinity surface layer reflects the estuarine nature of Pearl Harbor. As with salinity, corresponding concentrations of Si are consistently higher in the October survey compared to the September sampling.

Concentrations of dissolved inorganic plant nutrients (NO_3^-, PO_4^{3-}, NH_4^+) show distinctly different patterns. During the September sampling, the concentrations of NO_3^- were lowest in the surface and mid-depth samples compared to bottom samples, in contrast to concentrations of Si, which were highest at the surface (Figure 4). In all cases, concentrations of NO_3^- in surface samples were very low, near the limit of detection (Figure 4). During the October sampling, such a pattern was not evident, with some of the highest concentrations of NO_3^- in surface samples (Figure 19).

Concentrations of PO_4^{3-} (Figure 5) and NH_4^+ (Figure 6) in September also showed slight vertical gradients with lowest concentrations in surface waters, and highest near the bottom. These gradients were small compared to those of NO_3^-. In addition, the concentrations of PO_4^{3-} and NH_4^+ were greater than measured for NO_3^-. In most marine environments in Hawaii, the concentrations of NO_3^- are generally higher than either PO_4^{3-} or NH_4^+. The relative decrease in the concentration of NO_3^- during the dry period when the September sampling occurred is likely a result of uptake by phytoplankton in the water column of Pearl Harbor.

During the October sampling, there is little indication of vertical gradients of either PO_4^{3-} (Figure 20) or NH_4^+ (Figure 21). Overall, concentrations of all dissolved inorganic nutrients at all stations were higher in October compared to September. The relative increase in concentrations and lack of vertical gradients appears to be a result of rainfall that occurred prior to the October sampling.

Values of dissolved organic nitrogen and dissolved organic phosphorus in September (Figures 7 and 8) show no distinct vertical or horizontal stratification and are relatively constant throughout the sampling regime. Similarly, concentrations of total nitrogen (Figure 9) and total phosphorus (Figure 10) show no distinct patterns with depth or distance in the harbor in September. During the October survey, concentrations of dissolved organic nitrogen and phosphorus were slightly higher in surface samples and decreased with depth (Figures 22 and 23). Concentrations of total nitrogen (Figure 24) and total phosphorus (Figure 25) also decreased slightly with depth in the water column in October.

With one exception (bottom sample, Station 6) TSS and turbidity were relatively uniform through the water column as well as over the horizontal span of the sampling regime in September (Figures 11 and 12). Both TSS and turbidity were elevated in the bottom sample at Station 6. It is possible that this anomaly was the result of resuspension of material into the water column from the sampling gear striking the bottom or from recent ship traffic rather than from any hydrographic factor unique to this site.

During the October sampling, the patterns of TSS and turbidity were substantially different than in September. While there was no apparent difference in TSS and turbidity with respect to depth during the September survey, both constituents were generally elevated in surface samples relative to mid-depth and bottom samples during

the October survey. Samples in October were collected during ship movements through the Pearl Harbor channel. Samples at Station 4 were collected immediately after a ship passed through the area. It can be seen that the ship passage caused extremely high concentrations of TSS (Figure 26) and turbidity (Figure 27) throughout the water column. Observations of the water surface indicated that the turbid plume created by the propellor wash of the ship remained visible for approximately 30 minutes.

Concentrations of Chl *a*, temperature and dissolved oxygen also showed no apparent stratification during either the September survey (Figure 13) or the October survey (Figure 28). Overall, concentrations of Chl *a* were slightly elevated in September relative to October.

Also shown in Tables 1-4 are the results of replicate samples collected during each survey. With the exception of NH_4^+, all replicates are in close agreement. Concentrations of NH_4^+ commonly vary in such a manner as a result of biotic activity in samples collected in Hawaiian water. Thus, the variation replicate samples is not likely not an analytical artifact.

Figures 14-16 show vertical profiles of salinity, temperature and turbidity at the 10 sampling stations during the September survey, while Figures 29-31 show similar profiles in October. Profiles are shown in three groupings; Stations 1-3 near the berthing are; Stations 4-7 in the Ford Island channel; and Stations 8-10 in the main entrance channel. As with the discrete samples, it can be seen in Figures 14 and 29 that there is a general gradient of decreasing salinity with depth. Surface salinity was lower at all stations during October compared to September, while bottom salinities were similar during both surveys. The steeper gradients and reduced surface salinity reflect the recent rainfall in the Pearl Harbor area. During September the gradients are steepest in the upper 1-2 m of Stations 1-3, at a depth of 7-8 m at Stations 4-7, and from 2-6 m at Stations 8 and 10 (data were lost from Station 9). During October the gradients were steepest at Stations 5 and 10.

Profiles of temperature showed virtually mirror images of salinity during both surveys, with a warmer surface layer relative to bottom water (Figures 15 and 30). The steepest gradients of temperature were at the same depths as the steepest gradients of salinity.

Profiles of turbidity showed relatively constant values through the upper water column at all stations in September (Figure 16). Many of the stations had increasing turbidity in

the lower water column near the sediment-water interface. As with the discrete samples, the highest turbidity was near the bottom at Station 6. During October, profiles of turbidity were substantially more variable with overall higher concentrations than in September (Figure 31). It is also evident in the profile from Station that the recent passage of a large ship increases the turbidity substantially throughout the water column.

3.3.2. Compliance with DOH Criteria

Tables 1 and 2 show State of Hawaii Department of Health (DOH) water quality standards for the "not to exceed 2% and 10% of the time" and geometric mean criteria for the Pearl Harbor estuary. While these criteria are not statistically applicable with only a single sampling, comparison of the data with these limits is useful for gaining an understanding of the general state of water quality of the study area.

Inspection of Tables 1 and 2 indicates that no samples exceeded any of the DOH specific criteria. In fact, only several measurements were even within an order of magnitude of the specific criteria. In particular, all measurements of NO_3^- were at least an order of magnitude lower than DOH criteria. The wide discrepancy between measured data and DOH specific criteria is likely a response to the lack of rainfall during the days preceding the sampling. As a result, the measured water chemistry in the area of proposed dredging to support the homeporting reflected dry conditions with little apparent influence from surface runoff into Pearl Harbor. Should the survey be repeated following a period of heavy rainfall, it is likely that patterns of water chemistry, and the relationship with DOH criteria would have been substantially different.

4.0 MARINE BIOTIC ASSESSMENT

4.1 FIELD SURVEY PROCEDURES

4.1.1 Benthic Photo-transects

Past research has revealed that the harbor floor consists of mostly fine-grained sediment. At each of the 10 survey sites, bottom type and community structure were characterized by a photo-transect method. At each sampling location, a 25 m long transect tape was stretched along the bottom parallel to the axis of the channel. A

quadrat frame with dimensions of 1 m x 0.7 m (3 feet x 2 feet) was sequentially placed over 5 random marks on the transect tape so that the tape bisects the long axis of the frame. At each mark a color photograph recorded the segment of channel floor enclosed by the quadrat frame. Quadrats were photographed with a Nikonos camera with a super wide angle lens (15 mm, 94° field of view) using color film. In addition to the photo-quadrats, investigators visually estimated the percent cover of any benthic macro-biota, burrows, and bared substrata (i.e., sand, limestone, rubble) enclosed within the entire quadrat frame.

Following fieldwork, area coverage of each component of bottom cover in the quadrat photos was determined using an overlay grid. Benthic species and substratum type within each grid was summed to calculate area coverage. Field data provided input on small organisms that were not visible in photographs. Thus, the method provided for accurate estimates of cover of organisms that comprise a large percentage of the harbor floor through photographic coverage, as well as occurrence of very small and/or rare organisms that are not visible in photographs. Few, if any other methods provide for such accurate characterization of both extremes of benthic community structure.

Results of the photo-quadrats and in-situ cover estimates were used to calculate indices of community structure (e.g., percent cover, number of species, and species diversity). The photo-quadrat transect and analysis method is a modification of the technique described in Kinzie and Snider (1978), and has been employed in numerous field studies of Hawaiian reef communities (e.g., Dollar 1979, 1982, 1994, 1997; Dollar and Tribble 1993; Grigg and Maragos 1974).

Quantitative assessment of reef fish community structure was conducted in conjunction with the benthic surveys. As the transect tape was being laid along the bottom, all fish observed within a band approximately 2 meters wide along the transect path were identified by species name, abundance, and approximate size. Care was taken to conduct the fish surveys so that the minimum disturbance was created by divers, ensuring the least possible dispersal of fish. Only readily visible individuals were included in the census.

The solid structures consisting of the pilings of Piers B2/3 contained substantially different biota than the channel floor. As the pilings were not amenable to the photo-transect methods, biotic composition was assessed by compilation of a species list with ranking of relative abundance of organisms (e.g. rare, common, abundant), along with

photo-documentation of typical assemblages. Assemblages of fish within the piling structures were also assessed.

In addition, any endangered or protected species, particularly sea turtles, that were noted within the survey area were reported.

4.1.2 Benthic Infauna

Much of the biotic communities of the soft-sediment channel floor consisted of infauna. Assessment of infauna was conducted on representative core samples. Cores were hand-collected by inserting 4" PVC tubes into the sediment to a depth of approximately 10 cm, capping the top and bottom of the tube, and retrieving the sample. Triplicate cores were collected at each of the 10 sites. Once collected, these sediment samples were placed into jars, rinsing all material from the sampler into the sample jar. The sediment was fixed in 10 percent formalin and stained with rose bengal to aid the identification of live (at the time of sampling) material for approximately 48 hours. Samples were then elutriated and poured through 1.0 mm and 0.5 mm mesh sieves to retain the macrofauna, and subsequently transferred to 70% ethanol. Biota retained on the 1.0 mm sieve were sorted to major taxonomic groups. The material collected from the 0.5 mm size fraction was retained for reference, but was not analyzed further for this study.

4.2. RESULTS

4.2.1 Benthic Photo-transects

At all 10 survey stations, the overall physical composition of the channel floor was similar, consisting of very fine silt and mud perforated with numerous holes from burrowing organisms (Figure 17). At all stations, water clarity was very poor with limited visibility that decreased with depth. Near the bottom, visibility at many of the stations was near zero owing to high suspended loads of flocculent particulates. The fine grained material was easily stirred into suspension by the slightest movement of divers or survey equipment. Once flocculent material was stirred from the bottom, forming a dense cloud of high turbidity, the water column remained turbid, as currents near the bottom were near zero, and the settling velocity of the suspended material was long relative to dive time.

The planned benthic survey method involved placing a transect tape on the sediment surface and subsequently placing a quadrat frame over random marks on the tape. In practice, this method was only viable at Station 10 (Figure 18). At the other nine stations, the act of laying the quadrat frame on the tape was sufficient to consistently raise a turbidity cloud that completely restricted visibility. As a result, quantitative assessments of macrofauna were not possible at stations 1-9.

During the entire benthic survey, no motile invertebrates or fish were observed on the channel floor. However, as mentioned above, burrows were common throughout the survey area. At station 10, there was an average of 47.6 burrows per quadrat (n=5, s.d.=10.0), which equates to an average of 72 burrows m^2. Observations of the bottom at the other nine stations indicate similar burrow densities.

As noted in Section 4.2.2, neither the infaunal analysis nor the photo transect methods provided a means to explicitly identify the species responsible for the holes. However, past work in the harbor has shown that many of these holes are dug and occupied by a variety of crustaceans, molluscs, a few fishes and several other groups including a holothurian (*Chiridota rigida*) and sipunculan (*Sipunculus* sp.). Bivalve molluscs found in the sediment include the tellinid *Angulus nucella* and clam *Hiatella hawaiiensis*; and undoubtedly other mollusc species in this habitat. Swimming crabs include *Podophthalmus vigil*, *Portunus sanguinolentus*, *Scylla serrata*, and *Thalamita crenata*. Burrowing ghost shrimps (*Callinassa* sp.), and mantis shrimps (*Squilla* sp. and *Lysiosquilla maculata*) are also occasionally encountered in this habitat. In general, the larger crustaceans (crabs and *Lysiosquilla*) are not usually seen underwater but are most easily found by placing bait on the bottom as an attractant. There are several small fishes that are often associated with burrows in the mud. Among these are a burrowing goby (*Oxyurichthys lonchotus*), an eleotrid (*Asterropteryx semipunctatus*), and the goby, (*Psilogobius mainlandi*)which lives as a commensal with the alpheid shrimp, *Alpheus mackayi*. (Bishop Museum 1977; Environmental Assessment Co. 1977).

Observations were also conducted of the dock pilings adjacent to Stations 1-3. Most of the submerged portions of the pilings were covered with a variety of sponges, primarily of the genera *Microciona* and *Halichondria* (Figure 19). Other prominent biota on the upper portions of the pilings were hydroids. Very few bivalves were observed on the pilings. Most of the biota on the pilings was coated with a layer of fine brown mud. The basal portions of most of the pilings were devoid of fouling growth, as was the sediment surface under the docks. No fish were observed during the entire

underwater survey of the dock area. Similarly, no endangered or protected species, particularly sea turtles, were observed at any time during the survey.

4.2.2. Benthic Infauna

Composition and consistency of sediments varied among the ten stations from very fine terrigenous mud to mud with mixed carbonate and unidentified broken shell pieces (from oysters, barnacles, etc.). However, within the replicates from a given station, the sample material appeared to be relatively homogeneous. Dark-colored fine sediment or mud was present in all samples except those from Station 8. Samples from Stations 1 (replicate nos. 1, 2, 3), 3 (replicate nos. 7, 8, 9), 4 (replicate nos. 10, 11, 12), and 5 (replicate nos. 13, 14, 15) were comprised entirely of the fine dark mud. The sediment from Station 2 (replicate nos. 3, 4, 5) was a mix of unidentified bryozoan, hydroid, barnacle, oyster, and tubeworm fragments mixed with fine mud. The material from Stations 6 (replicate nos. 16, 17, 18) and 9 (replicate nos. 25, 26, 27) was dominated by dark-colored fine mud with a considerable amount of rotting terrestrial vegetation mixed in. Also present in the material from Station 9 was what appeared to be charcoal in the mud. The sediment collected at Station 7 (replicate nos. 19, 20, 21) had fragments from unidentified serpulid tubeworms, bivalves (including the oyster *Ostrea sandvicensis*), gastropods, and sponge spicules. The material from Station 10 (replicate nos. 28, 29, 30) contained shell fragments from gastropods, bivalves, and serpulid tubeworms, as well as fragments of foraminiferans. The sediment from Station 8 (replicate nos. 22, 23, 24) was different from any of the others in that it was comprised of a very fine pale-colored mud which, based on color alone, was probably carbonate, thus having a reef origin. Because of the dark color, it is assumed that the fine mud encountered at the other stations is probably primarily basalt originating from land.

Table 5 shows results of infaunal analyses. The abundance of live-collected macrofauna retained on the 1.0 mm sieve is very low in all samples; no live-collected macrofauna was recorded in eight of the thirty samples (27% of the total). Those samples with no live-collected macrofauna included nos. 5, 8, 11, 12, 14, 18, and 22. The macrofauna retained on the 1.0 mm mesh sieve is dominated by polychaetes. Only one non-polychaete was found, an unidentified anemone in replicate no. 24. Only one replicate (no. 26) had three taxa present, 8 replicates (nos. 2, 3,10, 13, 24, 28, 29, and 30) had two taxa present, and the remaining 13 replicates had one taxon present. The overall grand mean number of taxa per sample is 1.1, while the range of mean taxa per station was 0.7 - 2.0.

Similarly, the abundance of individuals was low, with a range of mean individuals per station of 0.7 - 2.7. Two samples (replicate nos. 2 and 26) had five individual organisms present, two samples (nos. 28 and 30) had three organisms, eight samples (nos. 1, 3, 10, 13, 17, 23, 24, and 29) contained two organisms, and ten samples had only one individual present (nos. 4, 6, 7, 9, 15, 16, 19, 21, 25, and 27). As noted above, the remaining samples had no live-collected organisms present in the 1.0 mm size fraction. In terms of abundance, the polychaete *Capitella sp.* was the most common, occurring in 16 of the 30 samples. The second most common species were *Podarke sp.* and *Sternaspis sp.*, each occurring in three samples. The low number of organisms in the 1.0 mm size fraction samples precludes the use of any meaningful statistical procedures on these data.

The relatively low abundance and diversity of species in the samples examined in this study may be related to the fact that many of these samples were from active shipping channels. As large ships and their tug tenders move through the harbor they create considerable propellor wash which stirs up the sediment such that it is easily seen from the surface. At some sites this disturbance probably occurs multiple times per day. At such levels of disturbance, it is not surprising that the benthic fauna is rather depauperate. Analysis of sediment samples from areas in Pearl Harbor, but removed from active shipping lanes revealed substantially greater numbers of species and individuals (Environmental Assessment Co. 1997).

It is apparent the infaunal cores were not effective in sampling the organisms responsible for the numerous burrow holes observed in the harbor floor. Most of these organisms are very motile and are capable of avoiding the presence of divers by burrowing deep into the sediment.

5.0 SUMMARY and CONCLUSIONS

Results of the marine assessment reveal no particularly sensitive environmental conditions. Evaluation of water quality indicated vertical stratification of salinity suggesting input of freshwater into the estuary from either rainfall or groundwater discharge. Concentrations of nutrients and other constituents were far below all DOH water quality criteria (except turbidity in the wake of a ship) indicate that there is little input of potential pollutants in the vicinity of the project site at the time of sampling.

The data suggest that infaunal benthic communities are not well developed at the ten sites examined in this study. This poor community development may be due to the

location of the study sites in harbor channels and turning basins which are actively used by shipping. The movement of shipping through these areas causes considerable disturbance to the substratum by propellor wash. It is hypothesized that this high level of disturbance has resulted in the depauperate condition encountered in these communities. Benthic macrofauna appear abundant by the numerous burrows in the soft mud bottom. However, owing to their motility, these organisms were not sampled during this study. All of the burrowing organisms are likely found throughout the soft-bottom environments of Pearl Harbor, and do not appear to include any rare species. No endangered or protected species were observed in the area, and only green sea turtles would be expected to occur at any time in the vicinity of the proposed project.

Overall, results of the present survey indicate that the proposed activities should have little or no significant or irreversible impacts on the environmental setting off of the project area. The most likely mechanisms for negative impacts to marine ecosystems from the proposed activities are removal of sediment to deepen the channels, and increases in turbidity associated with the dredging and sediment removal. While infaunal organisms will undoubtedly be removed during the dredging operation, there should be a large reservoir of undisturbed biota that to recolonize the channel areas following completion of the project.

While the magnitude of sediment resuspension may be substantial for the period of the dredging operation, it is apparent that resuspension is presently a normal component of this environment. Frequent transit of the harbor channels by deep draft ships resuspends surface sediment in a manner that probably does not differ qualitatively from that which would occur during dredging. While resuspension may temporarily increase from the present level during dredging activities, it does not appear that any aspect of the marine environment is presently at a threshold level that would be affected by temporarily increased sediment suspension. Rather, the existing biotic communities appear to be presently limited to organisms that can tolerate high suspended sediment loads.

Short term changes in water quality resulting from construction would also not be of a magnitude to affect benthic composition in the vicinity of the project site. Normal fluctuations in water chemistry in the Harbor as a function of rainfall are likely of a higher magnitude than the changes in water chemistry that may occur as a result of the proposed project. While the appearance of endangered or protected species is not likely, it is a possibility that such species, particularly sea turtles could enter the area during the dredging. Mitigation measures could include temporary suspension of

operations until endangered species leave the work area. It appears that as long as reasonable steps are taken in dredging practices, there should be no adverse impacts to the marine environment from the proposed project.

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TABLE 1. Results of water quality analyses (in micromolar units (µM) for applicable constituents) from samples collected at 10 stations in Pearl Harbor, Hawaii on September 16, 1997. "S" indicates surf surface sample, "M" indicates mid depth sample, and "B" indicates bottom sample. For station location, see Figure 1.

STATION No.	DEPTH	PO_4 (µM)	NO_3 (µM)	NH_4 (µM)	SI (µM)	DOP (µM)	DON (µM)	TP (µM)	TN (µM)	TURB (ntu)	TSS (mg/l)	SALT (o/oo)	pH (rel)	Chl-a (µg/l)	Temp. (deg. C.)	O_2 (mg/l)	O_2 (%sat)
1	S	0.09	0.01	0.02	25.07	0.37	10.30	0.46	10.33	0.32	3.00	33.34	8.10	0.70	28.24	7.39	91.23
	M	0.14	0.12	0.09	7.00	0.37	10.15	0.51	10.36	0.30	2.20	34.54	8.12	0.87	27.92	7.29	90.00
	B	0.14	0.06	0.15	9.18	0.35	10.47	0.49	10.68	0.50	2.53	34.62	8.08	0.73	27.74	7.40	91.36
2	S	0.10	0.00	0.05	20.57	0.40	8.73	0.50	8.78	0.33	2.27	33.58	8.13	0.90	28.26	7.58	93.77
	M	0.18	0.01	0.04	13.69	0.37	8.69	0.55	8.74	0.40	2.60	34.10	8.11	1.29	27.97	7.26	89.63
	B	0.15	0.05	0.13	7.78	0.35	10.02	0.50	10.20	0.38	2.07	34.56	8.11	0.74	27.61	7.29	90.00
3	S	0.10	0.01	0.07	23.68	0.40	10.67	0.50	10.75	0.39	2.13	33.49	8.13	0.80	28.14	7.56	93.33
	M	0.15	0.02	0.09	11.88	0.38	10.83	0.53	10.94	0.33	2.00	34.20	8.12	0.79	27.96	7.26	89.63
	B	0.14	0.03	0.14	9.33	0.36	9.63	0.50	9.80	0.31	1.93	34.58	8.09	0.73	27.63	7.50	92.71
4	S	0.11	0.02	0.09	14.91	0.39	11.61	0.50	11.72	0.35	1.93	34.00	8.11	0.58	28.07	7.44	91.90
	M	0.14	0.02	0.11	14.34	0.39	10.74	0.53	10.87	0.33	2.20	34.02	8.12	0.77	27.96	7.45	92.01
	B	0.18	0.23	0.31	11.86	0.36	12.50	0.54	13.04	0.36	1.87	34.55	8.06	0.78	27.60	7.43	91.70
5	S	0.10	0.04	0.20	14.81	0.42	13.17	0.52	13.41	0.37	2.33	34.05	8.12	0.82	28.07	7.50	92.70
	M	0.16	0.03	0.13	14.19	0.40	9.78	0.56	9.94	0.50	2.87	34.14	8.12	1.45	27.91	7.44	92.01
	B	0.19	0.06	0.17	12.38	0.36	10.92	0.55	11.15	0.51	2.53	34.39	8.08	1.93	27.61	7.22	89.37
6	S	0.11	0.02	0.11	15.39	0.41	10.72	0.52	10.85	0.33	1.80	33.94	8.13	0.63	28.20	7.82	95.34
	M	0.22	0.03	0.10	13.70	0.29	8.92	0.51	9.05	0.78	4.00	34.08	8.12	1.01	28.07	7.43	91.51
	B	0.20	0.07	0.20	12.69	0.36	9.96	0.56	10.23	1.42	10.87	34.47	8.06	1.16	27.79	7.58	93.79
7	S	0.16	0.02	0.23	14.80	0.37	9.92	0.53	10.17	0.59	3.67	34.11	8.12	1.04	28.01	7.46	92.10
	M	0.17	0.02	0.08	12.65	0.38	12.74	0.55	12.84	0.46	3.20	34.20	8.11	1.62	28.00	7.50	92.59
	B	0.19	0.04	0.28	12.51	0.34	10.28	0.53	10.60	0.43	3.00	34.58	8.04	1.16	27.58	7.18	88.78
8	S	0.11	0.02	0.16	24.35	0.40	11.89	0.51	12.07	0.38	3.13	33.41	8.13	0.84	28.41	7.46	92.78
	M	0.14	0.01	0.06	14.30	0.36	11.78	0.50	11.85	0.52	5.20	33.99	8.13	1.28	28.11	7.60	93.83
	B	0.20	0.18	0.30	8.80	0.36	10.57	0.56	11.05	0.53	3.00	34.59	8.10	0.86	27.75	7.54	93.12
9	S	0.10	0.03	0.10	28.52	0.42	13.19	0.52	13.32	0.50	3.07	33.02	8.14	1.30	28.52	8.25	101.85
	M	0.12	0.04	0.13	18.35	0.42	13.39	0.54	13.56	0.40	2.93	33.69	8.14	1.32	28.10	7.87	97.16
	B	0.13	0.14	0.23	8.46	0.39	10.61	0.52	10.98	0.45	2.87	34.51	8.11	0.96	27.83	7.68	94.81
10	S	0.10	0.04	0.10	21.84	0.39	12.10	0.49	12.24	0.41	2.47	33.43	8.14	1.22	28.46	7.21	89.01
	M	0.10	0.04	0.16	20.38	0.42	11.98	0.52	12.18	0.39	3.07	33.61	8.14	1.15	28.06	7.56	93.33
	B	0.14	0.20	0.19	7.77	0.34	10.82	0.48	11.21	0.31	2.53	34.48	8.12	0.84	28.90	7.65	94.44
10REP	S	0.12	0.06	0.24	21.63	0.38	9.98	0.50	10.28	0.39	3.67	33.46	8.14	1.41	28.46	7.34	90.62
	M	0.11	0.05	0.34	20.50	0.40	11.76	0.51	12.15	0.51	4.00	33.56	8.14	1.04	28.06	7.55	93.21
	B	0.13	0.16	0.37	7.69	0.37	8.16	0.50	8.69	0.41	2.13	34.47	8.12	0.72	28.90	7.69	94.94
DOH WQS for PEARL HARBOR ESTUARY																	
Geo. Mean			1.07	0.71				1.94	21.43	4.00				3.50			
10%			2.86	1.43				4.19	39.29	8.00				10.00			
2%			5.00	2.14				6.45	53.57	15.00				20.00			

TABLE 2. Results of water quality analyses (in units of micrograms per liter {µg/L} for applicable constituents) from samples collected at 10 stations in Pearl Harbor, Hawaii on September 16, 1997. "'S" indicates surface sample, "M" indicates mid depth sample, and "B" indicates bottom sample. For station location, see Figure 1.

STATION No.	DEPTH	PO4 (µg/L)	NO3 (µg/L)	NH4 (µg/L)	SI (µg/L)	DOP (µg/L)	DON (µg/L)	TP (µg/L)	TN (µg/L)	TURB (ntu)	TSS (mg/L)	SALINITY (o/oo)	pH (rel)	Chl-a (µg/l)	Temp. (deg. C.)	O2 (mg/l)	O2 (%sat)
1	S	2.79	0.14	0.28	701.96	11.47	144.20	14.26	144.62	0.32	3.00	33.34	8.10	0.696	28.24	7.39	91.23
	M	4.34	1.68	1.26	196.00	11.47	142.10	15.81	145.04	0.30	2.20	34.54	8.12	0.867	27.92	7.29	90.00
	B	4.34	0.84	2.10	257.04	10.85	146.58	15.19	149.52	0.50	2.53	34.62	8.08	0.728	27.74	7.40	91.36
2	S	3.10	0.14	0.70	575.96	12.40	122.22	15.50	122.92	0.33	2.27	33.58	8.13	0.899	28.26	7.58	93.77
	M	5.58	0.14	0.56	383.32	11.47	121.66	17.05	122.36	0.40	2.60	34.10	8.11	1.293	27.97	7.26	89.63
	B	4.65	0.70	1.82	217.84	10.85	140.28	15.50	142.80	0.38	2.07	34.56	8.11	0.736	27.61	7.29	90.00
3	S	3.10	0.14	0.98	663.04	12.40	149.38	15.50	150.50	0.39	2.13	33.49	8.13	0.795	28.14	7.56	93.33
	M	4.65	0.28	1.26	332.64	11.78	151.62	16.43	153.16	0.33	2.00	34.20	8.12	0.790	27.96	7.26	89.63
	B	4.34	0.42	1.96	261.24	11.16	134.82	15.50	137.20	0.31	1.93	34.58	8.09	0.733	27.63	7.50	92.71
4	S	3.41	0.28	1.26	417.48	12.09	162.54	15.50	164.08	0.35	1.93	34.00	8.11	0.580	28.07	7.44	91.90
	M	4.34	0.28	1.54	401.52	12.09	150.36	16.43	152.18	0.33	2.20	34.02	8.12	0.773	27.96	7.45	92.01
	B	5.58	3.22	4.34	332.08	11.16	175.00	16.74	182.56	0.36	1.87	34.55	8.06	0.780	27.60	7.43	91.70
5	S	3.10	0.56	2.80	414.68	13.02	184.38	16.12	187.74	0.37	2.33	34.05	8.12	0.815	28.07	7.50	92.70
	M	4.96	0.42	1.82	397.32	12.40	136.92	17.36	139.16	0.50	2.87	34.14	8.12	1.449	27.91	7.44	92.01
	B	5.89	0.84	2.38	346.64	11.16	152.88	17.05	156.10	0.51	2.53	34.39	8.08	1.935	27.61	7.22	89.37
6	S	3.41	0.28	1.54	430.92	12.71	150.08	16.12	151.90	0.33	1.80	33.94	8.13	0.634	28.20	7.82	95.34
	M	6.82	0.42	1.40	383.60	8.99	124.88	15.81	126.70	0.78	4.00	34.08	8.12	1.006	28.07	7.43	91.51
	B	6.20	0.98	2.80	355.32	11.16	139.44	17.36	143.22	1.42	10.87	34.47	8.06	1.157	27.79	7.58	93.79
7	S	4.96	0.28	3.22	414.40	11.47	138.88	16.43	142.38	0.59	3.67	34.11	8.12	1.038	28.01	7.46	92.10
	M	5.27	0.28	1.12	354.20	11.78	178.36	17.05	179.76	0.46	3.20	34.20	8.11	1.620	28.00	7.50	92.59
	B	5.89	0.56	3.92	350.28	10.54	143.92	16.43	148.40	0.43	3.00	34.58	8.04	1.162	27.58	7.18	88.78
8	S	3.41	0.28	2.24	681.80	12.40	166.46	15.81	168.98	0.38	3.13	33.41	8.13	0.837	28.41	7.46	92.78
	M	4.34	0.14	0.84	400.40	11.16	164.92	15.50	165.90	0.52	5.20	33.99	8.13	1.276	28.11	7.60	93.83
	B	6.20	2.52	4.20	246.40	11.16	147.98	17.36	154.70	0.53	3.00	34.59	8.10	0.857	27.75	7.54	93.12
9	S	3.10	0.42	1.40	798.56	13.02	184.66	16.12	186.48	0.50	3.07	33.02	8.14	1.298	28.52	8.25	101.85
	M	3.72	0.56	1.82	513.80	13.02	187.46	16.74	189.84	0.40	2.93	33.69	8.14	1.316	28.10	7.87	97.16
	B	4.03	1.96	3.22	236.88	12.09	148.54	16.12	153.72	0.45	2.87	34.51	8.11	0.956	27.83	7.68	94.81
10	S	3.10	0.56	1.40	611.52	12.09	169.40	15.19	171.36	0.41	2.47	33.43	8.14	1.216	28.46	7.21	89.01
	M	3.10	0.56	2.24	570.64	13.02	167.72	16.12	170.52	0.39	3.07	33.61	8.14	1.150	28.06	7.56	93.33
	B	4.34	2.80	2.66	217.56	10.54	151.48	14.88	156.94	0.31	2.53	34.48	8.12	0.845	28.90	7.65	94.44
10REP	S	3.72	0.84	1.36	605.64	11.78	139.72	15.50	143.92	0.39	3.67	33.46	8.14	1.407	28.46	7.34	90.62
	M	3.41	0.70	2.18	574.00	12.40	164.64	15.81	170.10	0.51	4.00	33.56	8.14	1.038	28.06	7.55	93.21
	B	4.03	2.24	2.76	215.32	11.47	114.24	15.50	121.66	0.41	2.13	34.47	8.12	0.716	28.90	7.69	94.94
DOH WQS for PEARL HARBOR ESTUARY																	
Geo. Mean			15.00	10.00				60.00	300.00	4.00				3.50			
10%			40.00	20.00				130.00	550.00	8.00				10.00			
2%			70.00	30.00				200.00	750.00	15.00				20.00			

TABLE 3. Results of water quality analyses (in micromolar (µM) units for applicable constituents) from samples collected at 10 stations in Pearl Harbor, Hawaii on October 9, 1997. "S" indicates surface surface sample, "M" indicates mid depth sample, and "B" indicates bottom sample. For station location, see Figure 1.

STATION No.	DEPTH	PO_4 (µM)	NO_3 (µM)	NH_4 (µM)	Si (µM)	DOP (µM)	DON (µM)	TP (µM)	TN (µM)	TURB (ntu)	TSS (mg/l)	SALT (o/oo)	pH (rel)	Chl-a (µg/l)	Temp. (deg. C.)	O_2 (mg/l)	O_2 (%sat)
1	S	0.20	0.02	0.06	35.64	0.45	12.15	0.65	12.23	0.62	2.93	32.71	8.10	1.17	28.30	7.60	93.83
	M	0.21	0.34	0.17	10.02	0.39	10.76	0.60	11.27	0.30	1.67	34.33	8.10	0.95	27.60	7.29	90.00
	B	0.19	0.04	0.11	5.43	0.35	10.32	0.54	10.47	0.38	1.53	34.80	8.12	0.91	27.10	7.40	91.36
2	S	0.21	0.48	0.45	37.93	0.44	10.47	0.65	11.40	0.75	7.93	32.17	8.12	0.77	28.25	7.39	91.23
	M	0.32	0.04	0.11	6.24	0.40	11.96	0.72	12.11	0.55	1.87	34.80	8.11	0.95	27.25	7.26	89.63
	B	0.13	0.12	0.13	4.14	0.39	9.42	0.52	9.67	0.50	1.33	34.90	8.14	0.72	27.10	7.54	93.09
3	S	0.12	0.08	0.21	36.81	0.37	9.81	0.49	10.10	0.90	2.67	32.40	8.13	0.95	28.15	7.56	93.33
	M	0.16	0.06	0.10	9.17	0.50	12.72	0.66	12.88	0.43	2.20	34.40	8.12	1.01	27.26	7.41	91.48
	B	0.13	0.04	0.11	4.61	0.40	10.41	0.53	10.56	0.48	2.27	34.85	8.14	0.72	27.10	7.51	92.72
4	S	0.23	0.05	0.24	21.46	0.40	11.62	0.63	11.91	3.80	29.13	33.74	8.12	1.08	27.97	7.43	91.73
	M	0.37	0.07	0.30	13.33	0.32	9.68	0.69	10.05	9.00	54.07	34.31	8.12	1.52	27.26	7.46	92.10
	B	0.24	0.15	0.20	6.16	0.42	10.04	0.66	10.39	3.30	19.93	34.86	8.12	1.01	27.30	7.42	91.60
5	S	0.14	0.24	0.29	56.42	0.50	14.92	0.64	15.45	0.79	4.20	31.81	8.12	0.79	28.45	7.46	92.10
	M	0.15	0.09	0.26	14.79	0.44	13.23	0.59	13.58	0.38	1.67	34.09	8.12	0.88	27.18	7.32	90.37
	B	0.20	0.08	0.20	22.11	0.40	12.88	0.60	13.16	0.68	3.00	33.76	8.11	1.20	27.02	7.24	89.38
6	S	0.11	0.00	0.18	28.59	0.47	12.00	0.58	12.18	0.55	2.40	33.12	8.13	0.89	28.12	7.71	95.19
	M	0.18	0.02	0.23	14.92	0.33	10.75	0.51	11.00	0.68	3.13	34.09	8.12	0.88	27.33	7.41	91.48
	B	0.12	0.01	0.20	4.77	0.45	9.43	0.57	9.64	0.40	1.93	34.86	8.14	0.70	27.08	7.60	93.83
7	S	0.16	0.01	0.25	37.82	0.47	13.48	0.63	13.74	0.76	4.93	32.67	8.13	0.74	28.49	7.55	93.21
	M	0.15	0.02	0.31	11.80	0.47	10.08	0.62	10.41	0.40	2.47	34.21	8.12	1.23	27.27	7.50	92.59
	B	0.16	0.04	0.30	7.50	0.42	10.51	0.58	10.85	0.44	2.47	34.69	8.12	1.03	27.03	7.20	88.89
8	S	0.11	0.02	0.25	30.04	0.39	13.93	0.50	14.20	0.54	2.93	32.97	8.13	1.16	28.42	7.52	92.84
	M	0.13	0.02	0.20	8.03	0.43	10.04	0.56	10.26	0.50	2.87	34.54	8.14	0.79	27.26	7.60	93.83
	B	0.13	0.08	0.23	4.08	0.41	9.48	0.54	9.79	0.44	2.40	34.88	8.15	0.66	27.02	7.55	93.21
9	S	0.10	0.02	0.19	37.44	0.46	13.38	0.56	13.59	0.60	3.00	32.46	8.11	1.20	28.30	7.21	89.01
	M	0.15	0.02	0.21	11.37	0.44	11.66	0.59	11.89	0.45	2.93	34.31	8.13	1.01	27.48	7.56	93.33
	B	0.15	0.04	0.22	6.29	0.41	12.09	0.56	12.35	0.36	1.00	34.70	8.14	0.73	27.14	7.65	94.44
9 REP	S	0.12	0.03	0.39	37.45	0.47	12.96	0.59	13.38	0.66	2.53	32.44	8.10	1.28	28.30	7.34	90.62
	M	0.16	0.03	0.36	11.27	0.47	12.74	0.63	13.13	0.60	2.07	34.30	8.13	0.96	27.48	7.55	93.21
	B	0.19	0.04	0.32	6.05	0.36	11.01	0.55	11.37	0.44	2.13	34.70	8.14	0.73	27.14	7.69	94.94
10	S	0.14	0.48	0.28	28.04	0.61	20.50	0.75	21.26	1.00	7.87	30.99	8.18	3.41	28.57	8.25	101.85
	M	0.11	0.05	0.27	7.94	0.44	15.25	0.55	15.57	0.34	0.67	34.44	8.16	0.86	27.48	7.87	97.16
	B	0.10	0.13	0.21	3.55	0.37	9.50	0.47	9.84	0.23	0.67	34.83	8.16	0.46	27.14	7.68	94.81
DOH WQS for PEARL HARBOR ESTUARY																	
Geo. Mean			1.07	0.71				1.94	21.43	4.00				3.50			
10%			2.86	1.43				4.19	39.29	8.00				10.00			
2%			5.00	2.14				6.45	53.57	15.00				20.00			

TABLE 4. Results of water quality analyses (in micrograms per liter{µg/L} for applicable constituents) from samples collected at 10 stations in Pearl Harbor, Hawaii on October 9, 1997. "S" indicates surface sample, "M" indicates mid depth sample, and "B" indicates bottom sample. For station location, see Figure 1.

STATION No.	DEPTH	PO4 (µg/L)	NO3 (µg/L)	NH4 (µg/L)	SI (µg/L)	DOP (µg/L)	DON (µg/L)	TP (µg/L)	TN (µg/L)	TURB (ntu)	TSS (mg/L)	SALINITY (o/oo)	pH (rel)	Chl-a (µg/l)	Temp. (deg. C.)	O2 (mg/l)	O2 (%sat)
1	S	6.20	0.28	0.84	997.92	9.45	170.10	20.15	171.22	0.62	2.93	32.71	8.10	1.17	28.30	7.60	93.83
	M	6.51	4.76	2.38	280.56	8.19	150.64	18.60	157.78	0.30	1.67	34.33	8.10	0.95	27.60	7.29	90.00
	B	5.89	0.56	1.54	152.04	7.35	144.48	16.74	146.58	0.38	1.53	34.80	8.12	0.91	27.10	7.40	91.36
2	S	6.51	6.72	6.30	1062.04	9.24	146.58	20.15	159.60	0.75	7.93	32.17	8.12	0.77	28.25	7.39	91.23
	M	9.92	0.56	1.54	174.72	8.40	167.44	22.32	169.54	0.55	1.87	34.80	8.11	0.95	27.25	7.26	89.63
	B	4.03	1.68	1.82	115.92	8.19	131.88	16.12	135.38	0.50	1.33	34.90	8.14	0.72	27.10	7.54	93.09
3	S	3.72	1.12	2.94	1030.68	7.77	137.34	15.19	141.40	0.90	2.67	32.40	8.13	0.95	28.15	7.56	93.33
	M	4.96	0.84	1.40	256.76	10.50	178.08	20.46	180.32	0.43	2.20	34.40	8.12	1.01	27.26	7.41	91.48
	B	4.03	0.56	1.54	129.08	8.40	145.74	16.43	147.84	0.48	2.27	34.85	8.14	0.72	27.10	7.51	92.72
4	S	7.13	0.70	3.36	600.88	8.40	162.68	19.53	166.74	3.80	29.13	33.74	8.12	1.08	27.97	7.43	91.73
	M	11.47	0.98	4.20	373.24	6.72	135.52	21.39	140.70	9.00	54.07	34.31	8.12	1.52	27.26	7.46	92.10
	B	7.44	2.10	2.80	172.48	8.82	140.56	20.46	145.46	3.30	19.93	34.86	8.12	1.01	27.30	7.42	91.60
5	S	4.34	3.36	4.06	1579.76	10.50	208.88	19.84	216.30	0.79	4.20	31.81	8.12	0.79	28.45	7.46	92.10
	M	4.65	1.26	3.64	414.12	9.24	185.22	18.29	190.12	0.38	1.67	34.09	8.12	0.88	27.18	7.32	90.37
	B	6.20	1.12	2.80	619.08	8.40	180.32	18.60	184.24	0.68	3.00	33.76	8.11	1.20	27.02	7.24	89.38
6	S	3.41	0.00	2.52	800.52	9.87	168.00	17.98	170.52	0.55	2.40	33.12	8.13	0.89	28.12	7.71	95.19
	M	5.58	0.28	3.22	417.76	6.93	150.50	15.81	154.00	0.68	3.13	34.09	8.12	0.88	27.33	7.41	91.48
	B	3.72	0.14	2.80	133.56	9.45	132.02	17.67	134.96	0.40	1.93	34.86	8.14	0.70	27.08	7.60	93.83
7	S	4.96	0.14	3.50	1058.96	9.87	188.72	19.53	192.36	0.76	4.93	32.67	8.13	0.74	28.49	7.55	93.21
	M	4.65	0.28	4.34	330.40	9.87	141.12	19.22	145.74	0.40	2.47	34.21	8.12	1.23	27.27	7.50	92.59
	B	4.96	0.56	4.20	210.00	8.82	147.14	17.98	151.90	0.44	2.47	34.69	8.12	1.03	27.03	7.20	88.89
8	S	3.41	0.28	3.50	841.12	8.19	195.02	15.50	198.80	0.54	2.93	32.97	8.13	1.16	28.42	7.52	92.84
	M	4.03	0.28	2.80	224.84	9.03	140.56	17.36	143.64	0.50	2.87	34.54	8.14	0.79	27.26	7.60	93.83
	B	4.03	1.12	3.22	114.24	8.61	132.72	16.74	137.06	0.44	2.40	34.88	8.15	0.66	27.02	7.55	93.21
9	S	3.10	0.28	2.66	1048.32	9.66	187.32	17.36	190.26	0.60	3.00	32.46	8.11	1.20	28.30	7.21	89.01
	M	4.65	0.28	2.94	318.36	9.24	163.24	18.29	166.46	0.45	2.93	34.31	8.13	1.01	27.48	7.56	93.33
	B	4.65	0.56	3.08	176.12	8.61	169.26	17.36	172.90	0.36	1.00	34.70	8.14	0.73	27.14	7.65	94.44
9 REP	S	3.72	0.42	5.46	1048.60	9.87	181.44	18.29	187.32	0.66	2.53	32.44	8.10	1.28	28.30	7.34	90.62
	M	4.96	0.42	5.04	315.56	9.87	178.36	19.53	183.82	0.60	2.07	34.30	8.13	0.96	27.48	7.55	93.21
	B	5.89	0.56	4.48	169.40	7.56	154.14	17.05	159.18	0.44	2.13	34.70	8.14	0.73	27.14	7.69	94.94
10	S	4.34	6.72	3.92	785.12	12.81	287.00	23.25	297.64	1.00	7.87	30.99	8.18	3.41	28.57	8.25	101.85
	M	3.41	0.70	3.78	222.32	9.24	213.50	17.05	217.98	0.34	0.67	34.44	8.16	0.86	27.48	7.87	97.16
	B	3.10	1.82	2.94	99.40	7.77	133.00	14.57	137.76	0.23	0.67	34.83	8.16	0.46	27.14	7.68	94.81
DOH WQS for PEARL HARBOR ESTUARY																	
Geo. Mean			15.00	10.00				60.00	300.00	4.00				3.50			
10%			40.00	20.00				130.00	550.00	8.00				10.00			
2%			70.00	30.00				200.00	750.00	15.00				20.00			

TABLE 5. Taxonomic list of all live-collected invertebrates retained on a 1.0 mm mesh sieve at 10 sampling stations in Pearl Harbor. For station locations, see Figure 1.

Station No.		1			2			3			4			5			6			7			8			9			10	
Replicate No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Taxonomic Unit																														
Phylum Cnidaria																														
Class Anthozoa																														
Order Actiniaria																														
Anemone sp.																								1						
Phylum Annelida																														
Class Polycheata																														
Fam. Hesionidae																														
Podarke sp.		1	1												1															
Fam. Spionidae																														
Prionospio steenstrupi																1			1											
P. cirrifera										1															1					
Fam. Capitellidae																														
Capitella sp.	2	4	1		1		1		1	1			1				2				1		2	1		1	1	2		2
Dasybranchus sp.																													1	
Fam. Chaetopteridae																														
Spiochaetopterus sp.																													1	
Fam. Cossuridae																														
Cossura sp.				1																										
Fam. Cirratulidae																														
Cirratulid sp.																														
Fam. Sternaspidae																														
Sternaspis sp.																										3		1		1
Fam. Sabellidae																														
Sabellid nov. sp.																										1				
NO. OF TAXA	1	2	2	1	0	1	1	0	1	2	0	0	2	0	1	1	1	0	1	0	1	0	1	2	1	3	1	2	2	2
NO. INDIVIDUALS	2	5	2	1	0	1	1	0	1	2	0	0	2	0	1	1	2	0	1	0	1	0	2	2	1	5	1	3	2	3
MEAN TAXA/STATION		1.7			0.7			0.7			0.7			1.0			0.7			0.7			1.0			1.7			2.0	
MEAN IND/STATION		3.0			0.7			0.7			0.7			1.0			1.0			0.7			1.3			2.3			2.7	

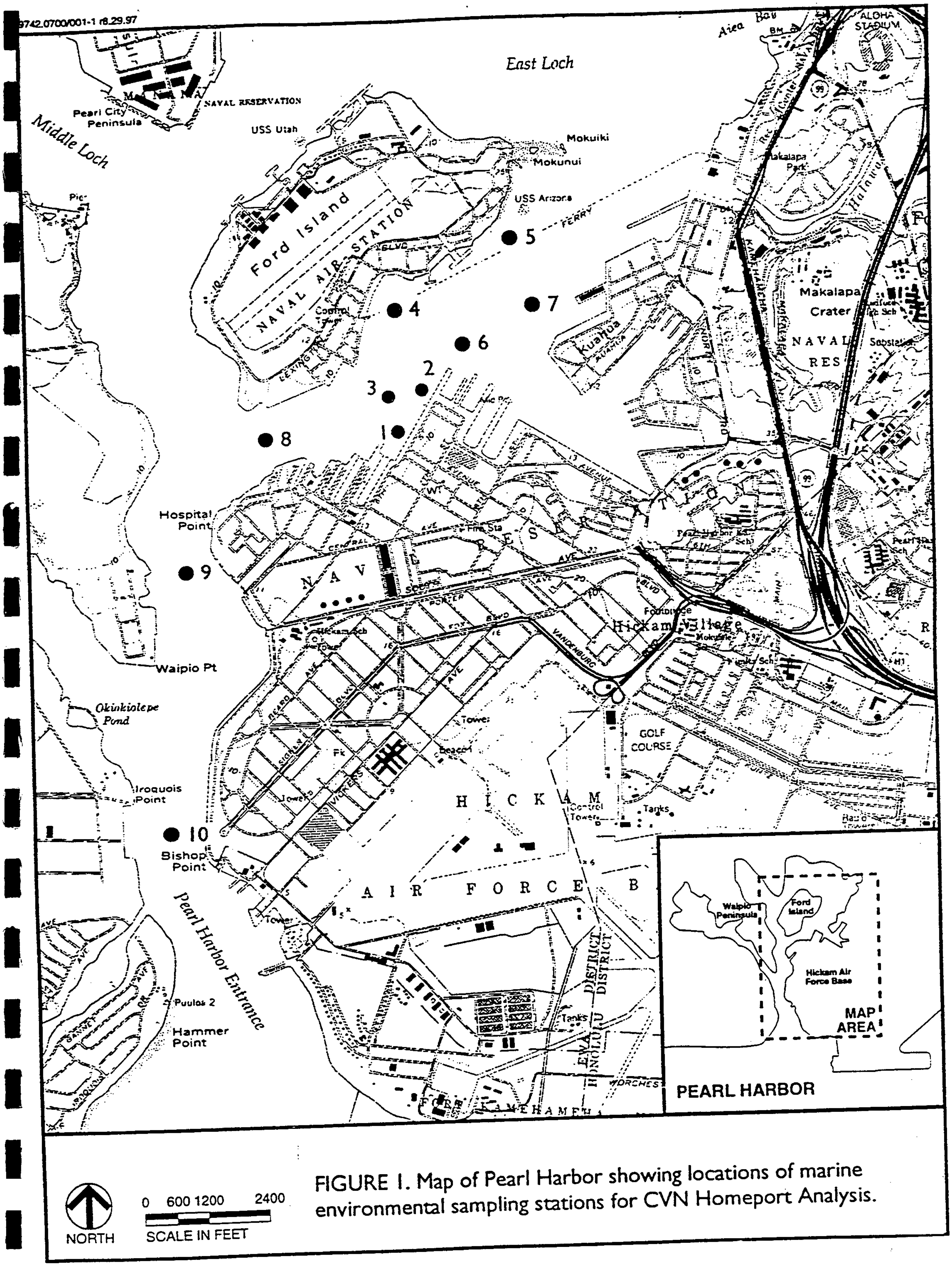

FIGURE 1. Map of Pearl Harbor showing locations of marine environmental sampling stations for CVN Homeport Analysis.

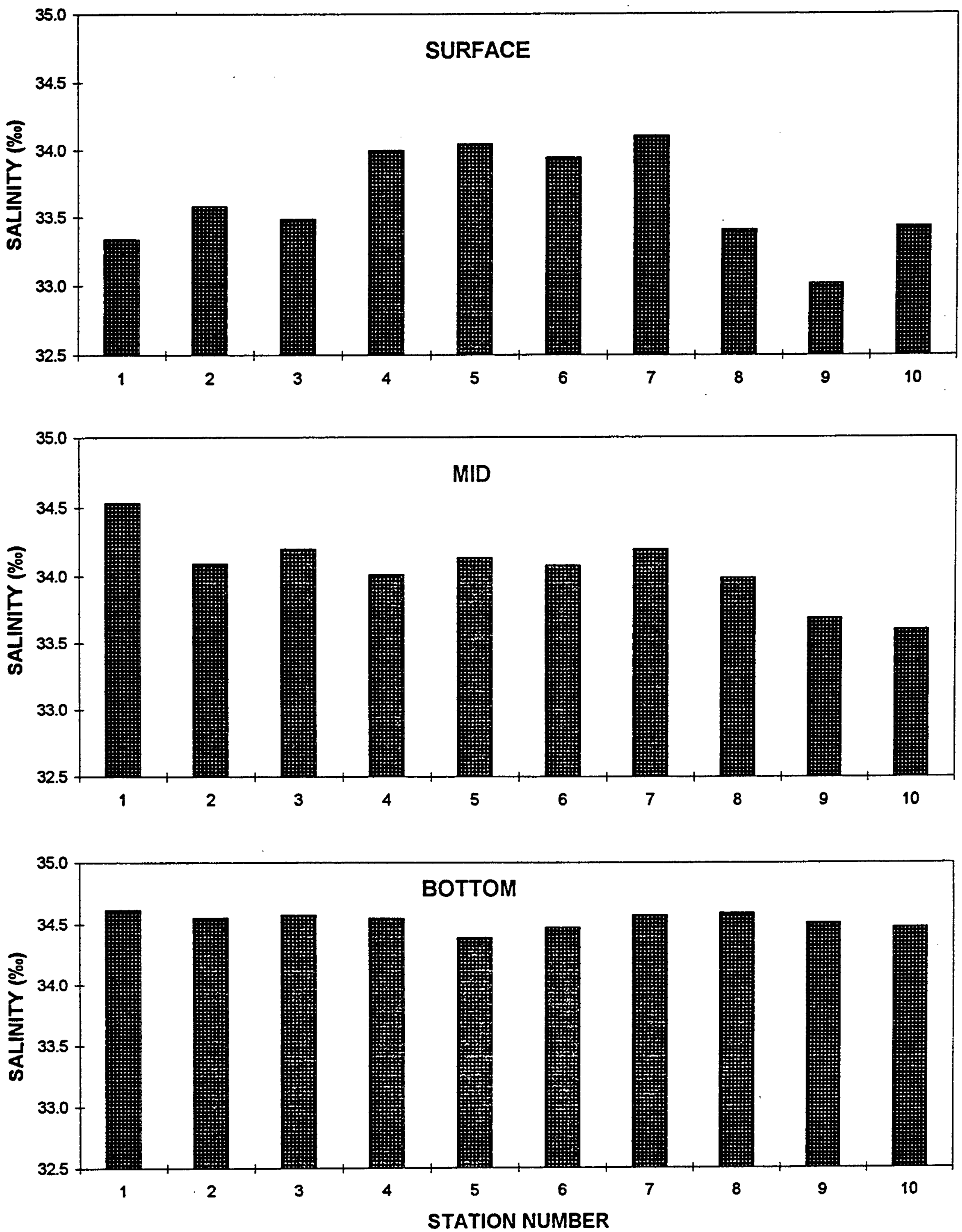

FIGURE 2. Measurements of salinity (in parts per thousand) in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on September 16, 1997. For station location, see Figure 1.

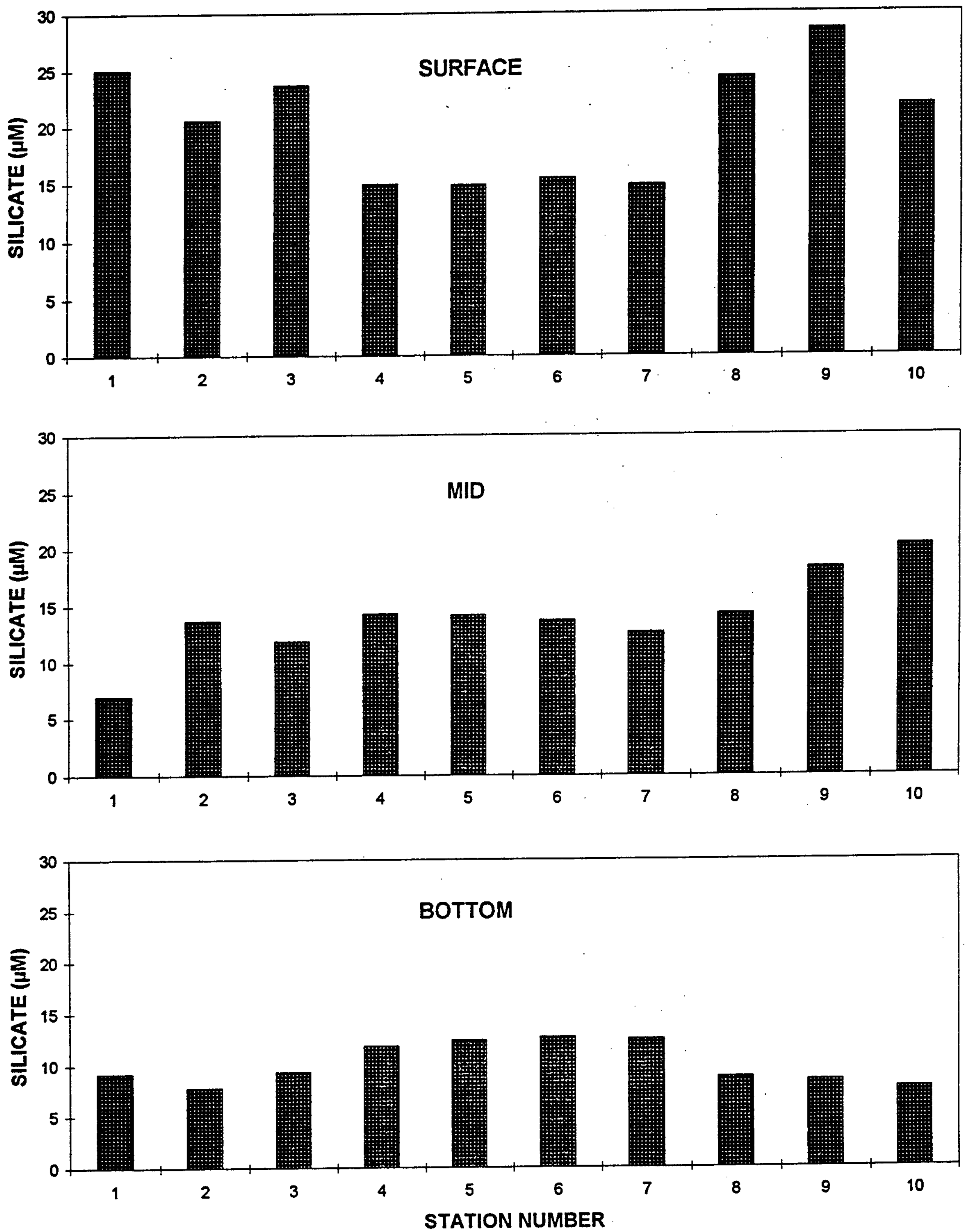

FIGURE 3. Measurements of silicate in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on September 16, 1997. For station location, see Figure 1.

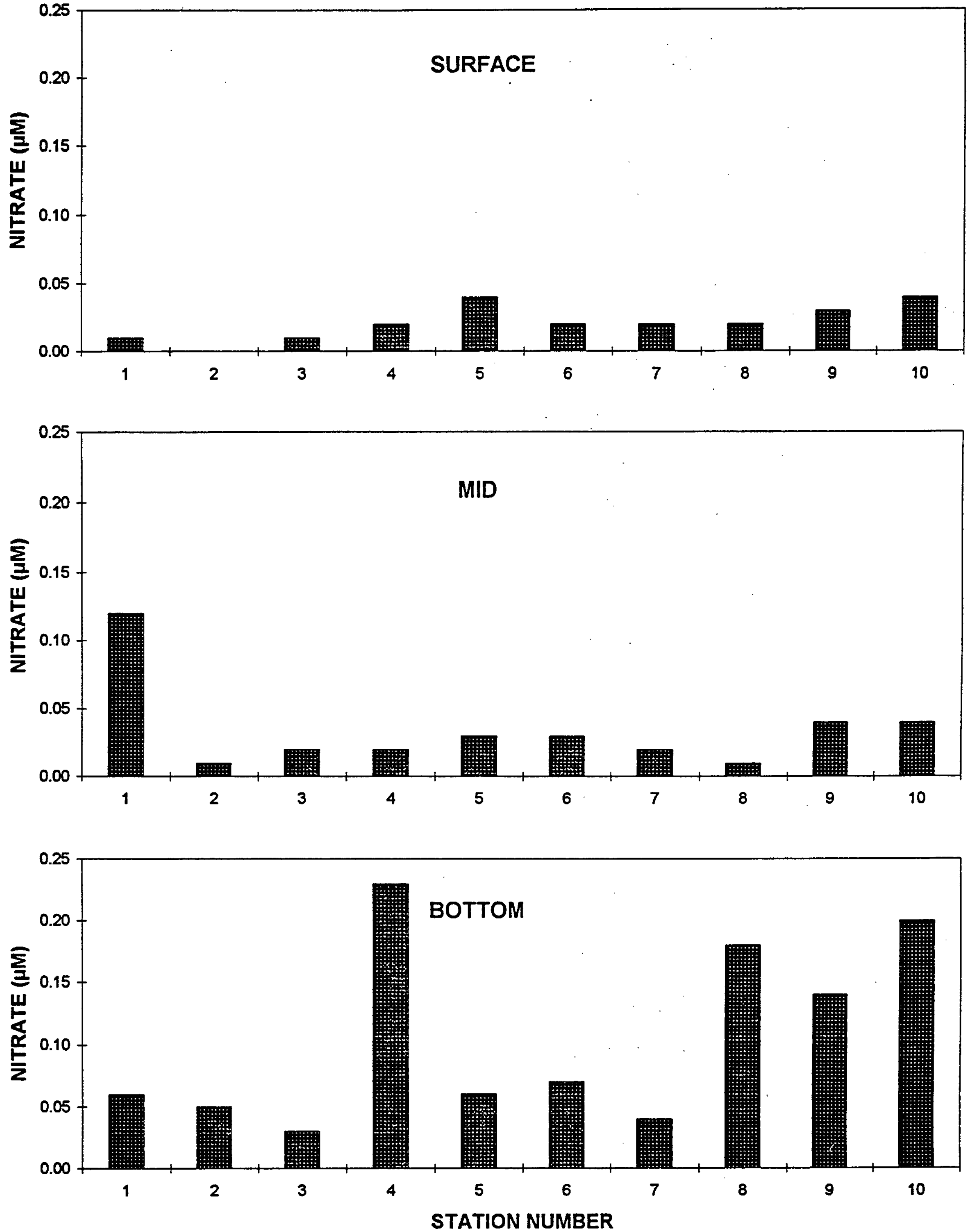

FIGURE 4. Measurements of nitrate in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on September 16, 1997. Absence of data bar indicates sample was below detection limit. For station location, see Figure 1.

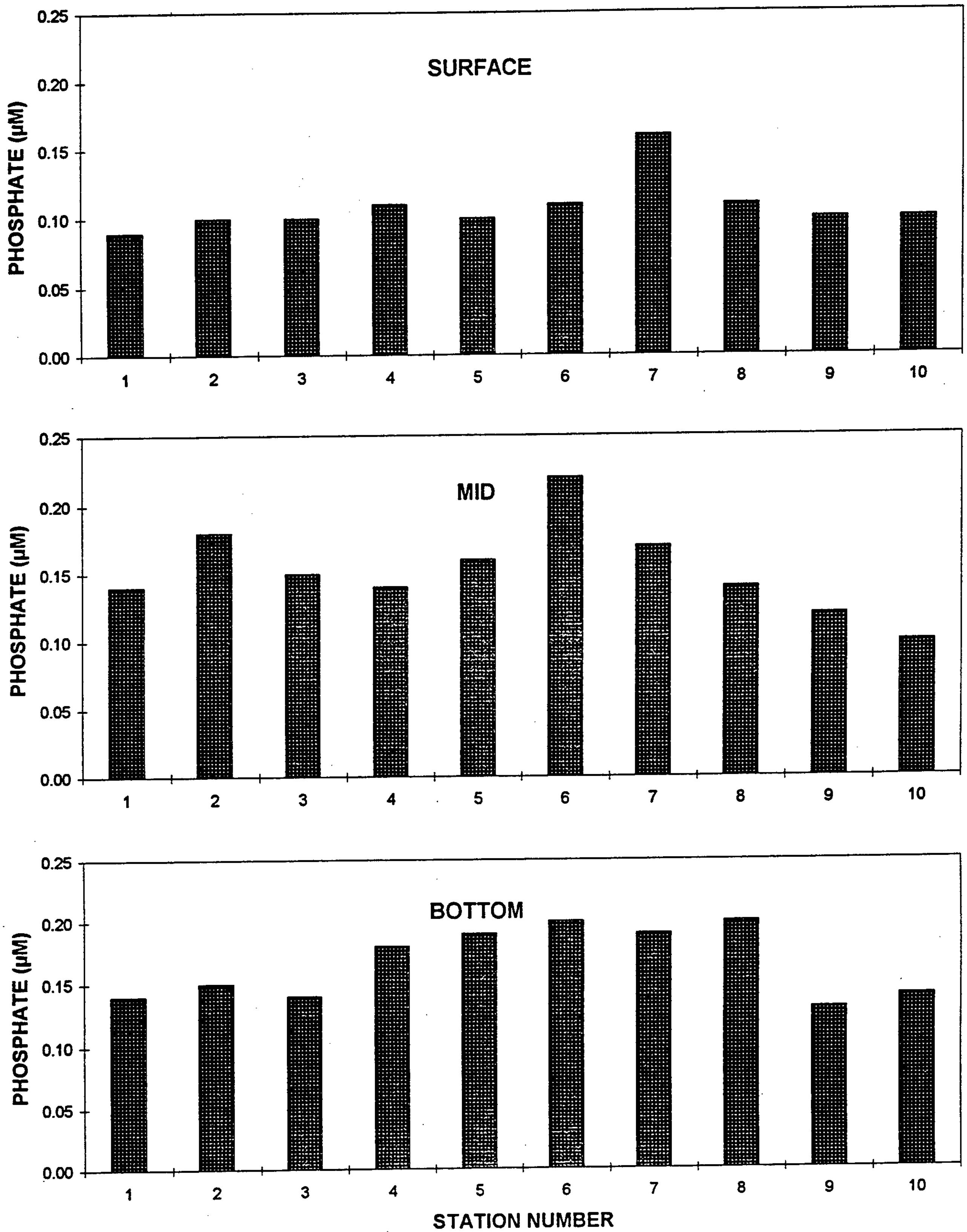

FIGURE 5. Measurements of phosphate in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on September 16, 1997. For station location, see Figure 1.

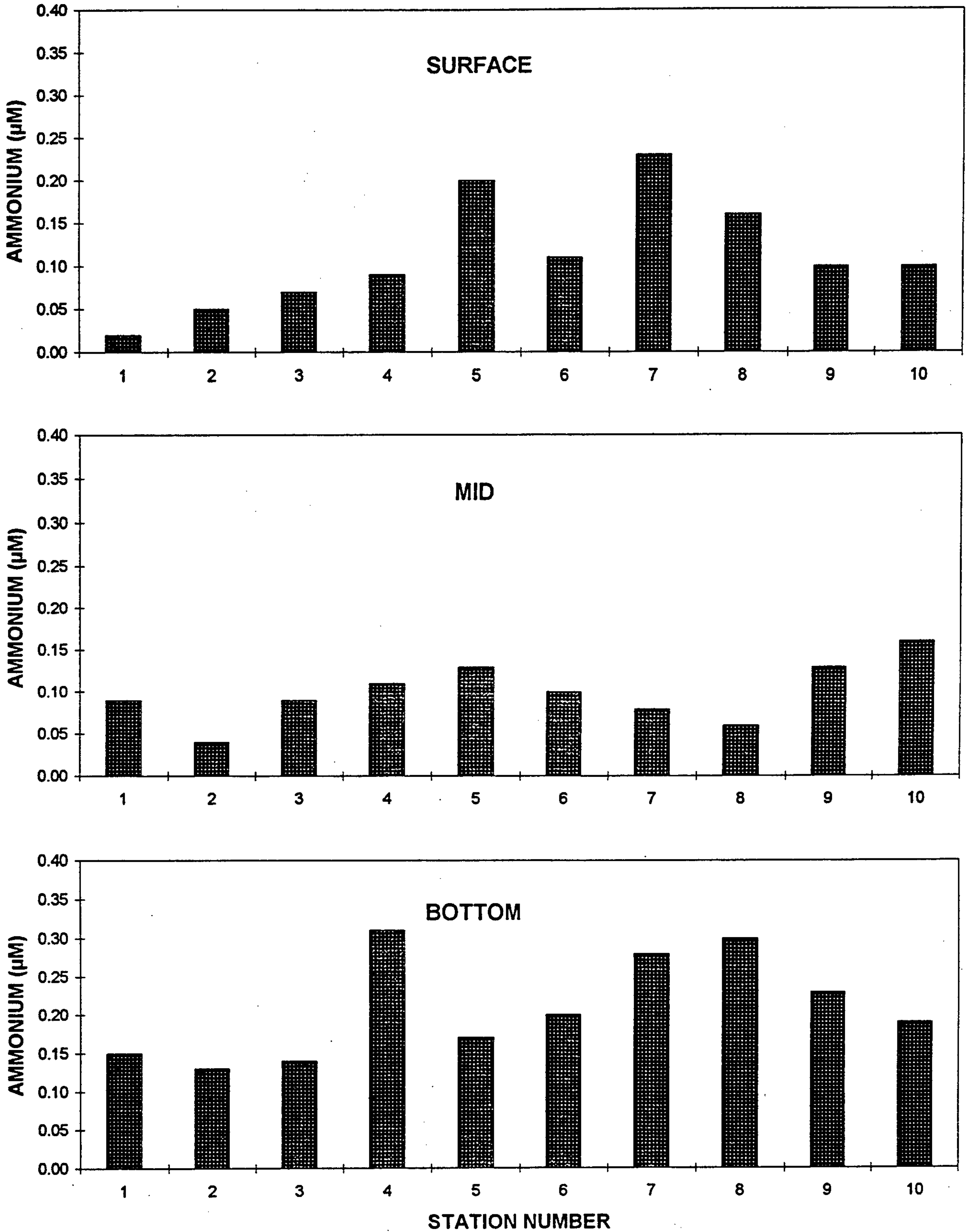

FIGURE 6. Measurements of ammonium in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on September 16, 1997. For station location, see Figure 1.

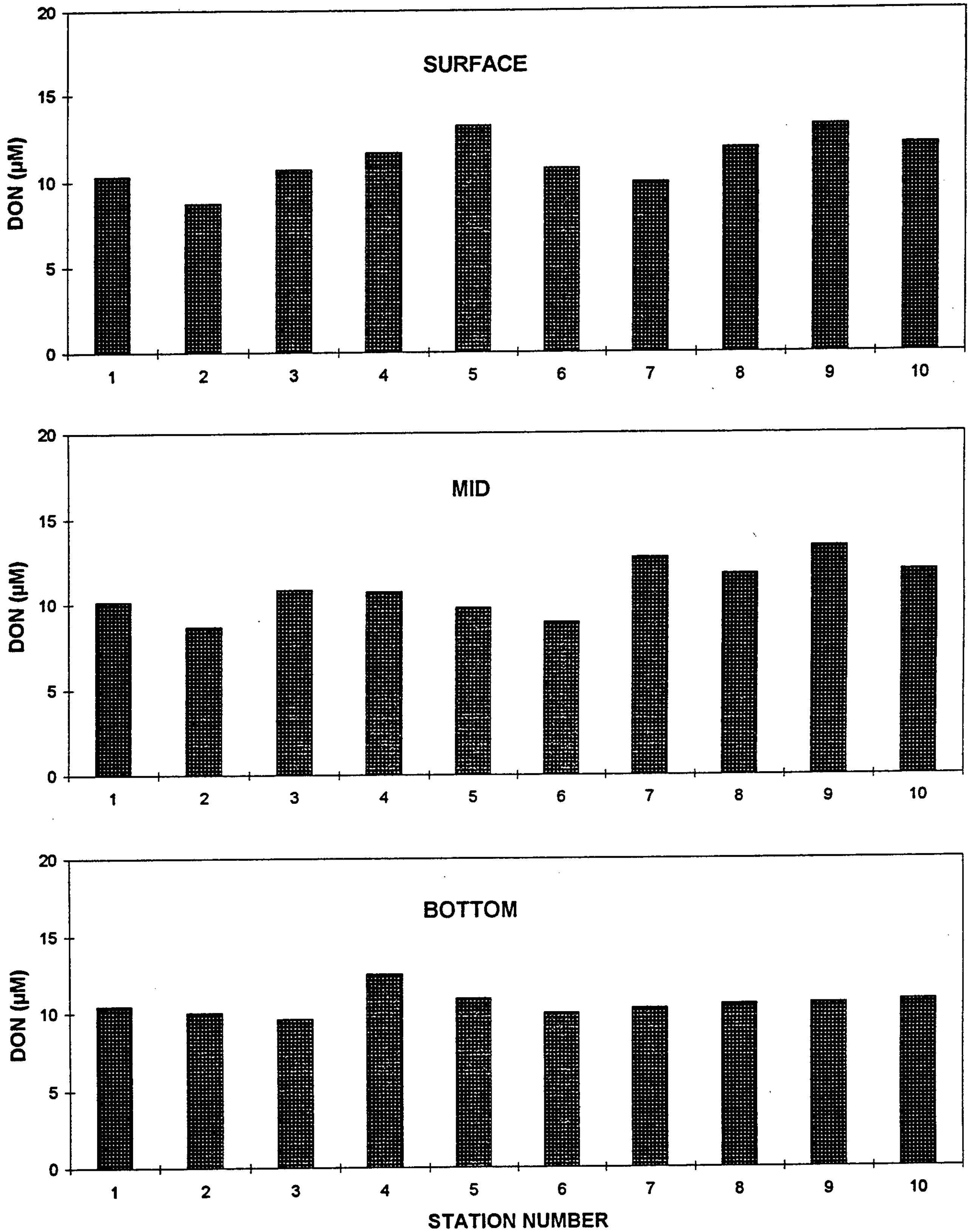

FIGURE 7. Measurements of dissolved organic nitrogen in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on September 16, 1997. For station location, see Figure 1.

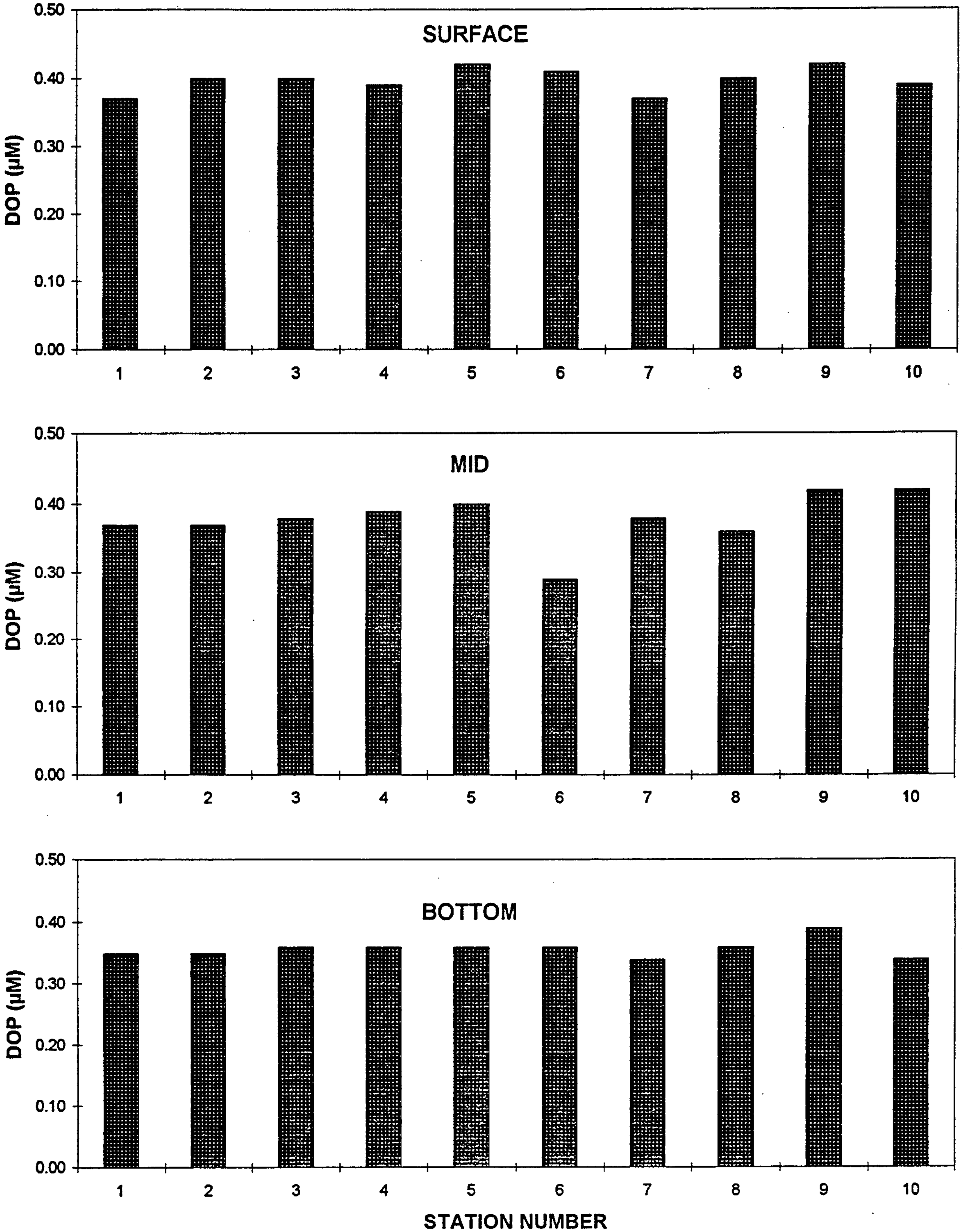

FIGURE 8. Measurements of dissolved organic phosphorus in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on September 16, 1997. For station location, see Figure 1.

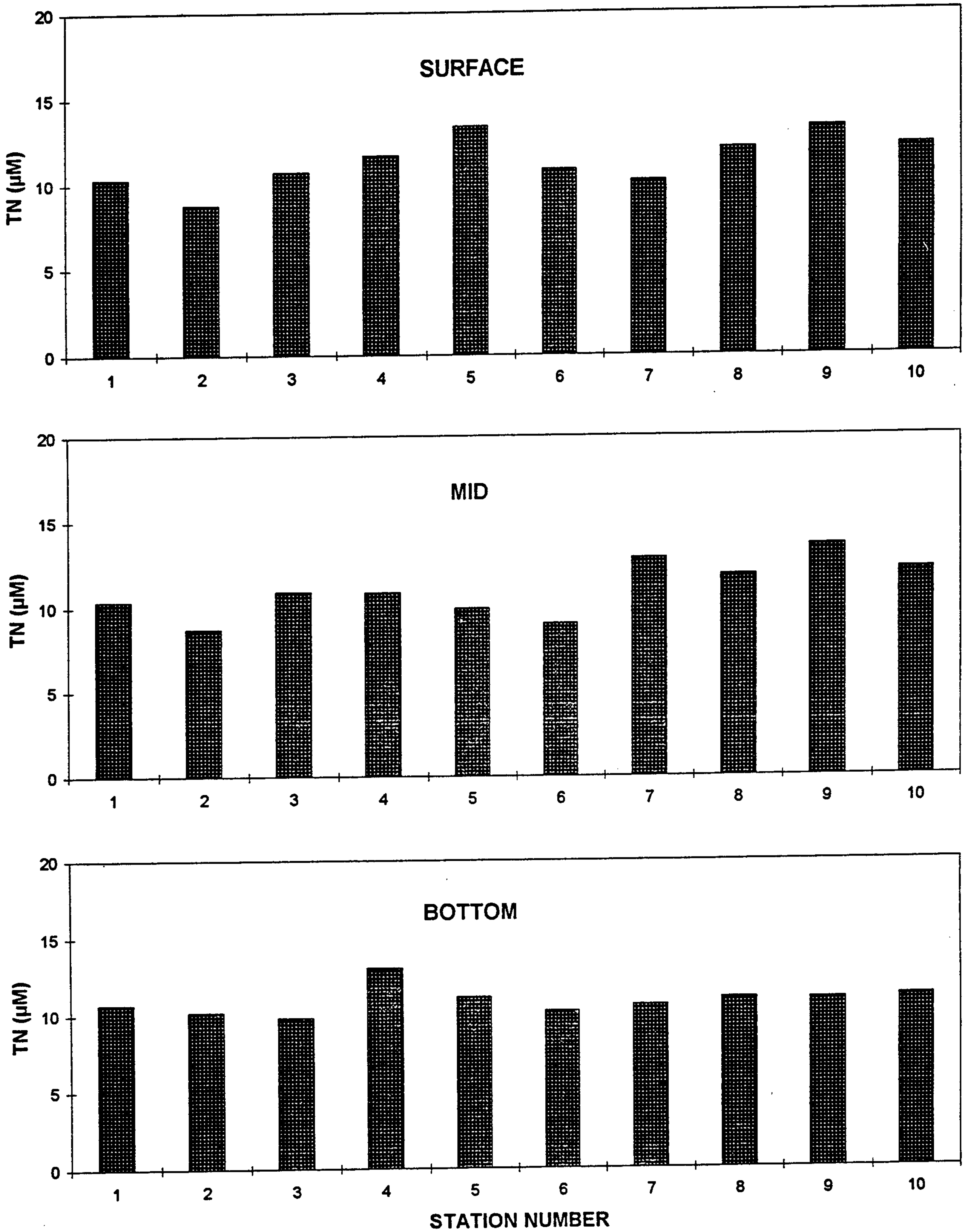

FIGURE 9. Measurements of total nitrogen in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on September 16, 1997. For station location, see Figure 1.

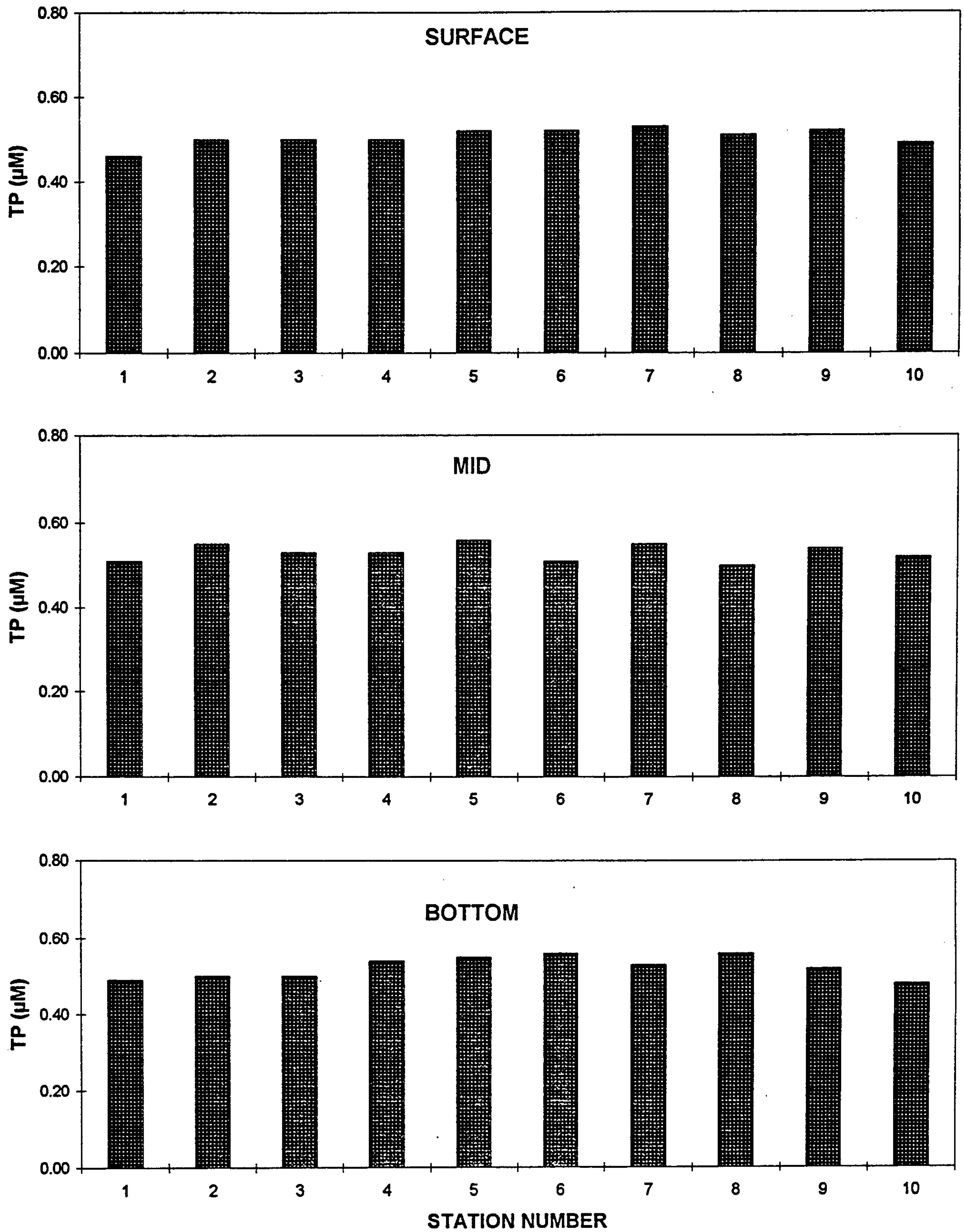

FIGURE 10. Measurements of total phosphorus in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on September 16, 1997. For station location, see Figure 1.

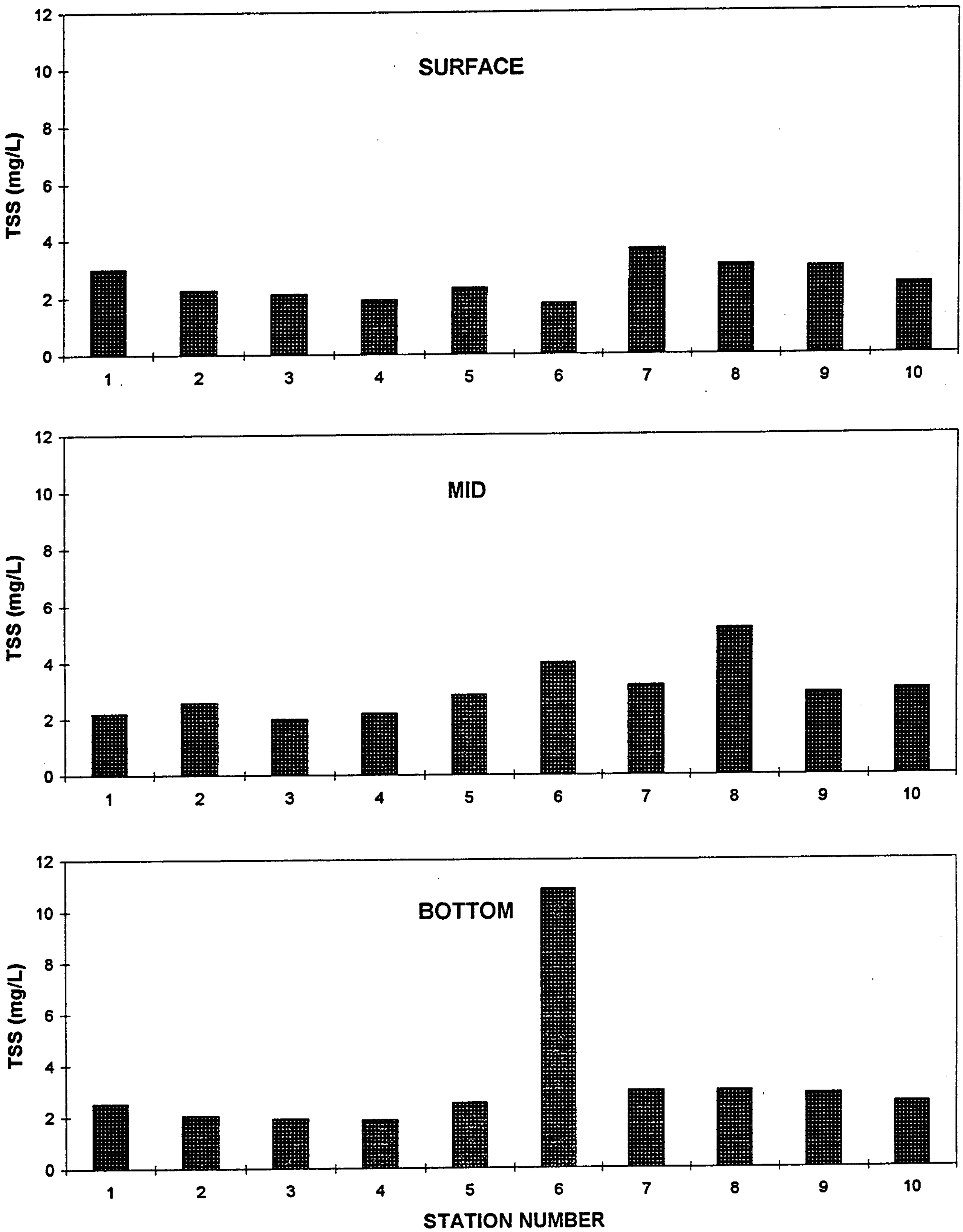

FIGURE 11. Measurements of total suspended solids in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on September 16, 1997. For station location, see Figure 1.

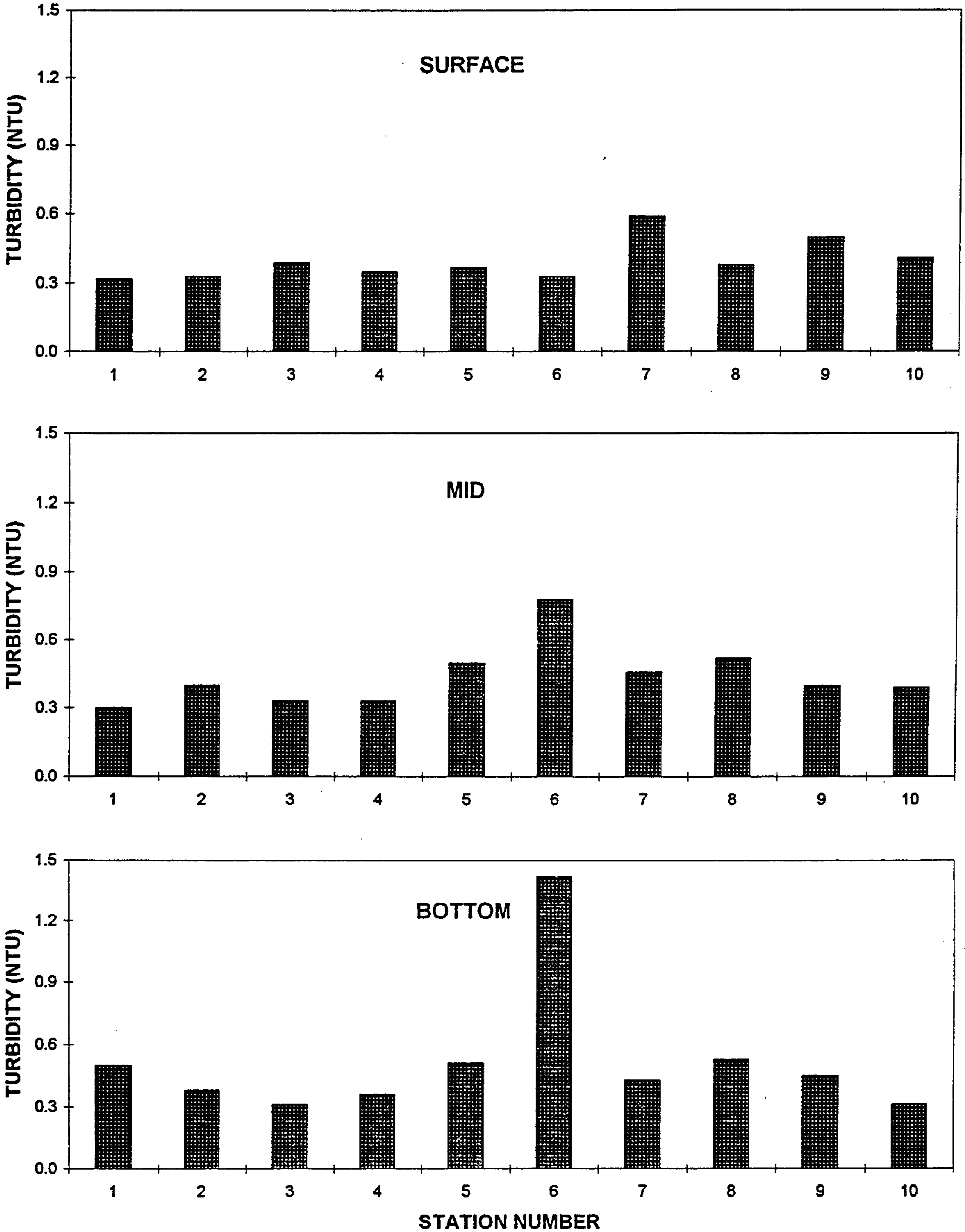

FIGURE 12. Measurements of turbidity in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on September 16, 1997. For station location, see Figure 1.

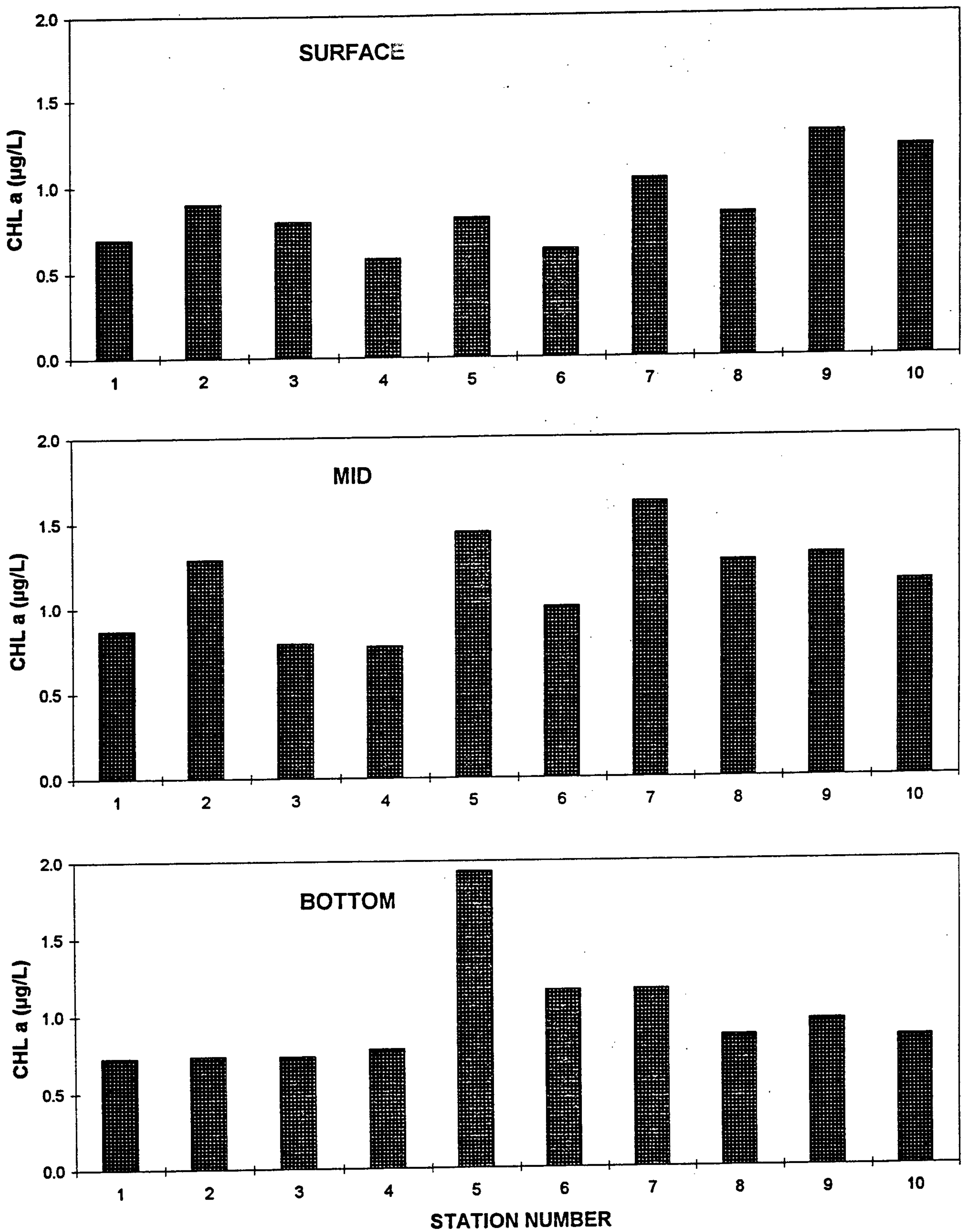

FIGURE 13. Measurements of chlorophyll *a* in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on September 16, 1997. For station location, see Figure 1.

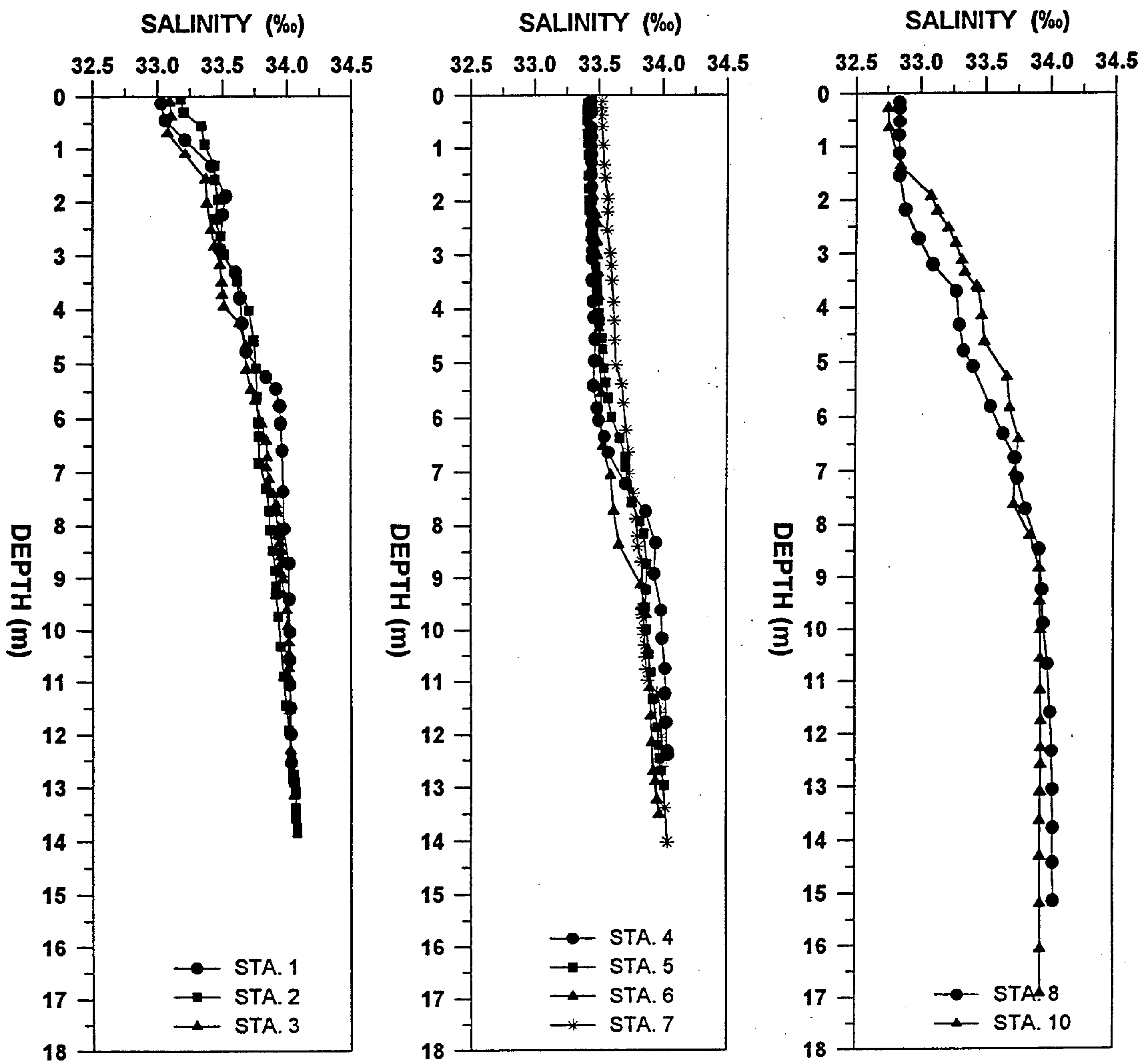

FIGURE 14. Continuous vertical profiles (in parts per thousand) of salinity at 9 stations in the vicinity of the Aircraft Carrier Homeporting project collected on September 16, 1997. Data for Station 9 not available. For station locations, see Figure 1.

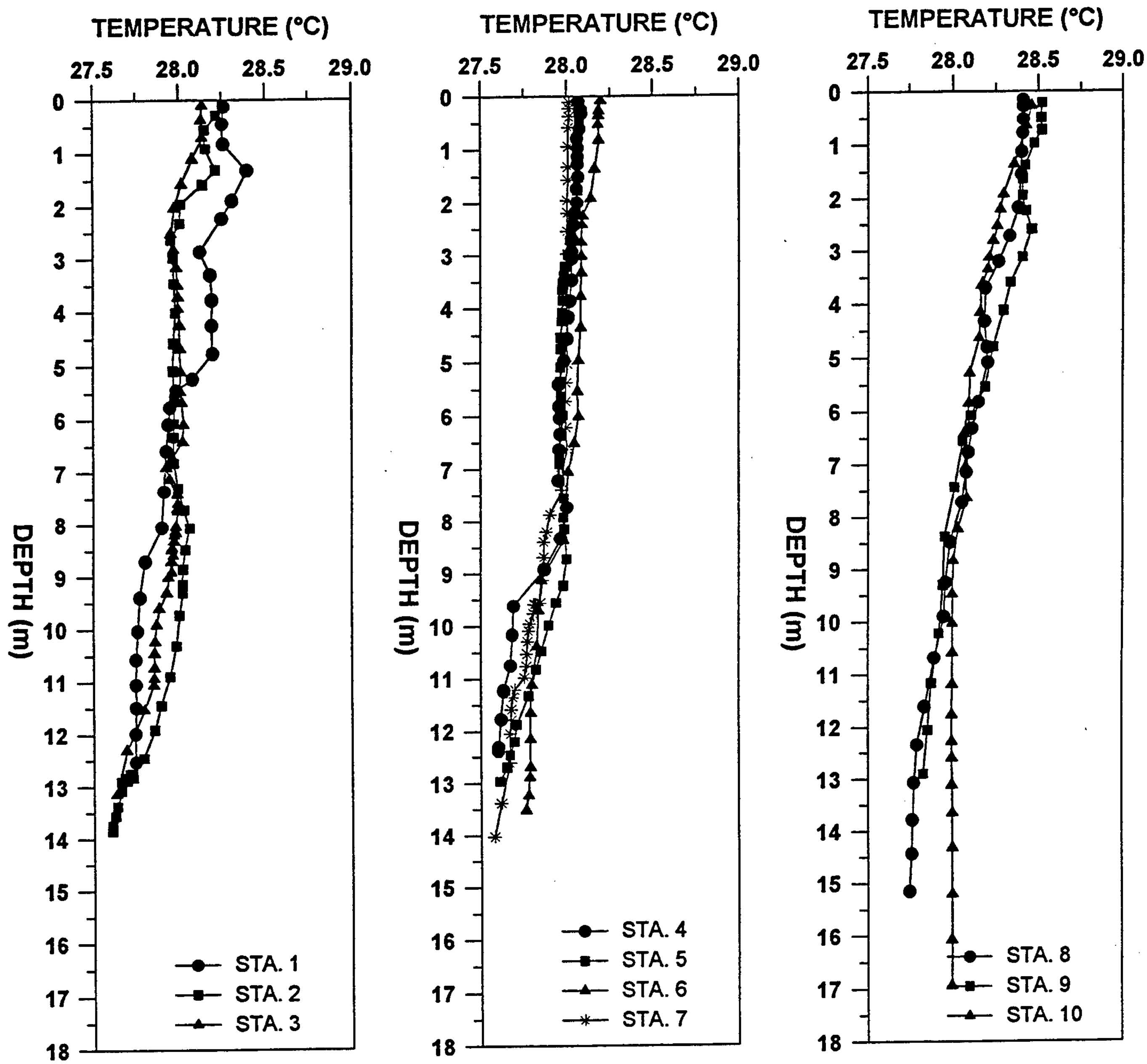

FIGURE 15. Continuous vertical profiles of temperature at 10 stations in the vicinity of the Aircraft Carrier Homeporting project collected on September 16, 1997. For station locations, see Figure 1.

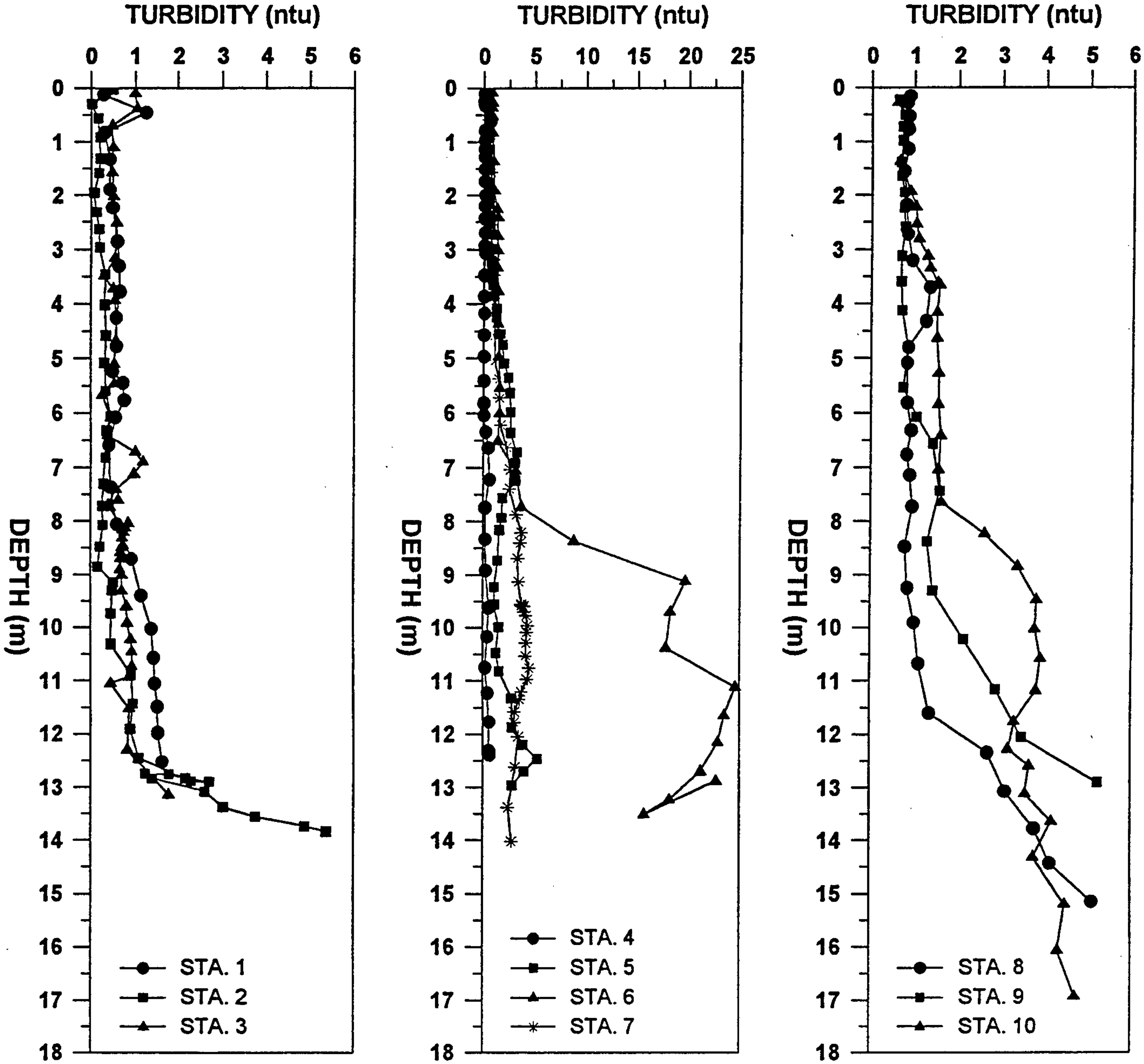

FIGURE 16. Continuous vertical profiles of turbidity at 10 stations in the vicinity of the Aircraft Carrier Homeporting project collected on September 16, 1997. Note x-axis scale change for Stations 4 - 7. For station locations, see Figure 1.

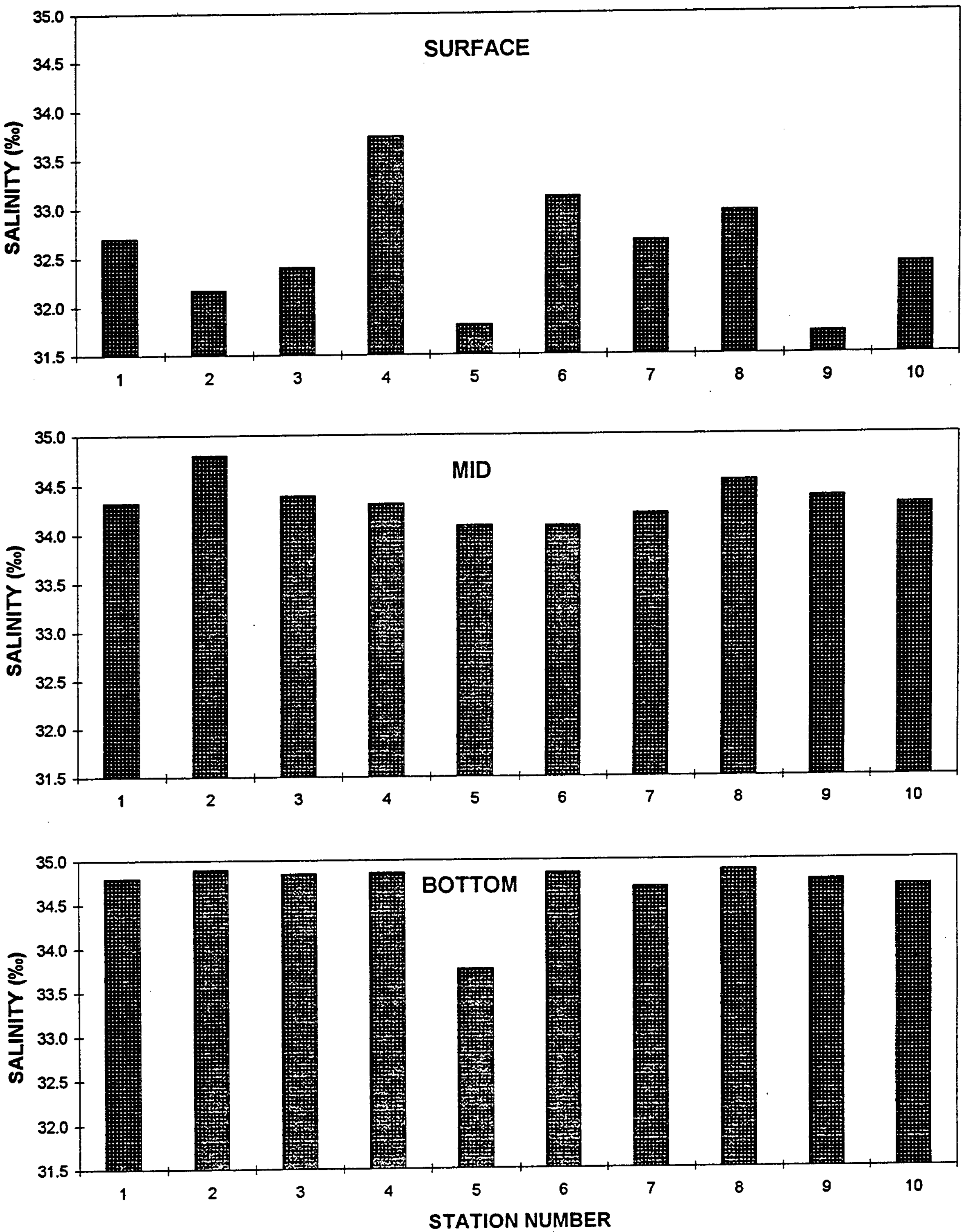

FIGURE 17. Measurements of salinity (in parts per thousand) in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on October 9, 1997. For station location, see Figure 1.

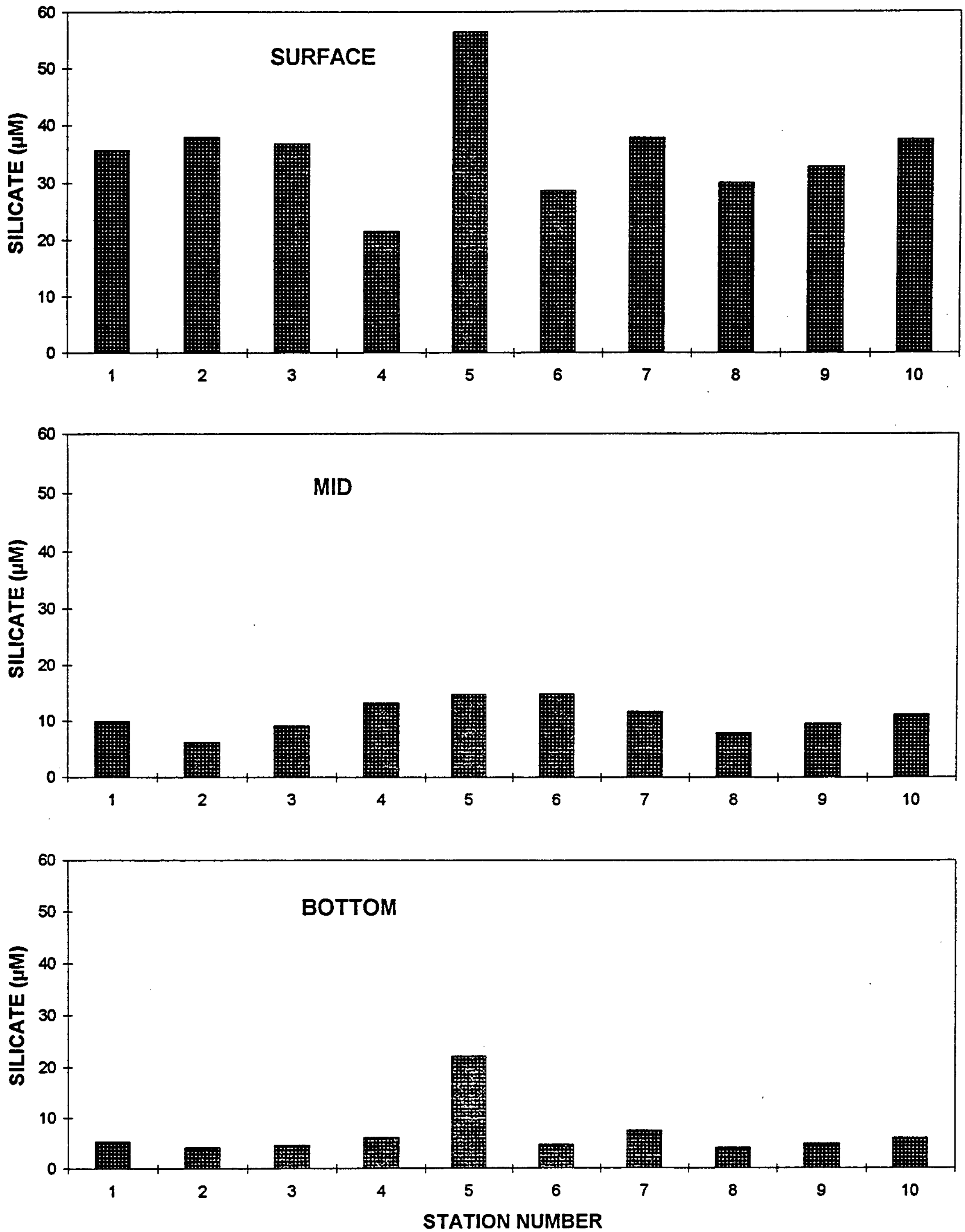

FIGURE 18. Measurements of silicate in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on October 9, 1997. For station location, see Figure 1.

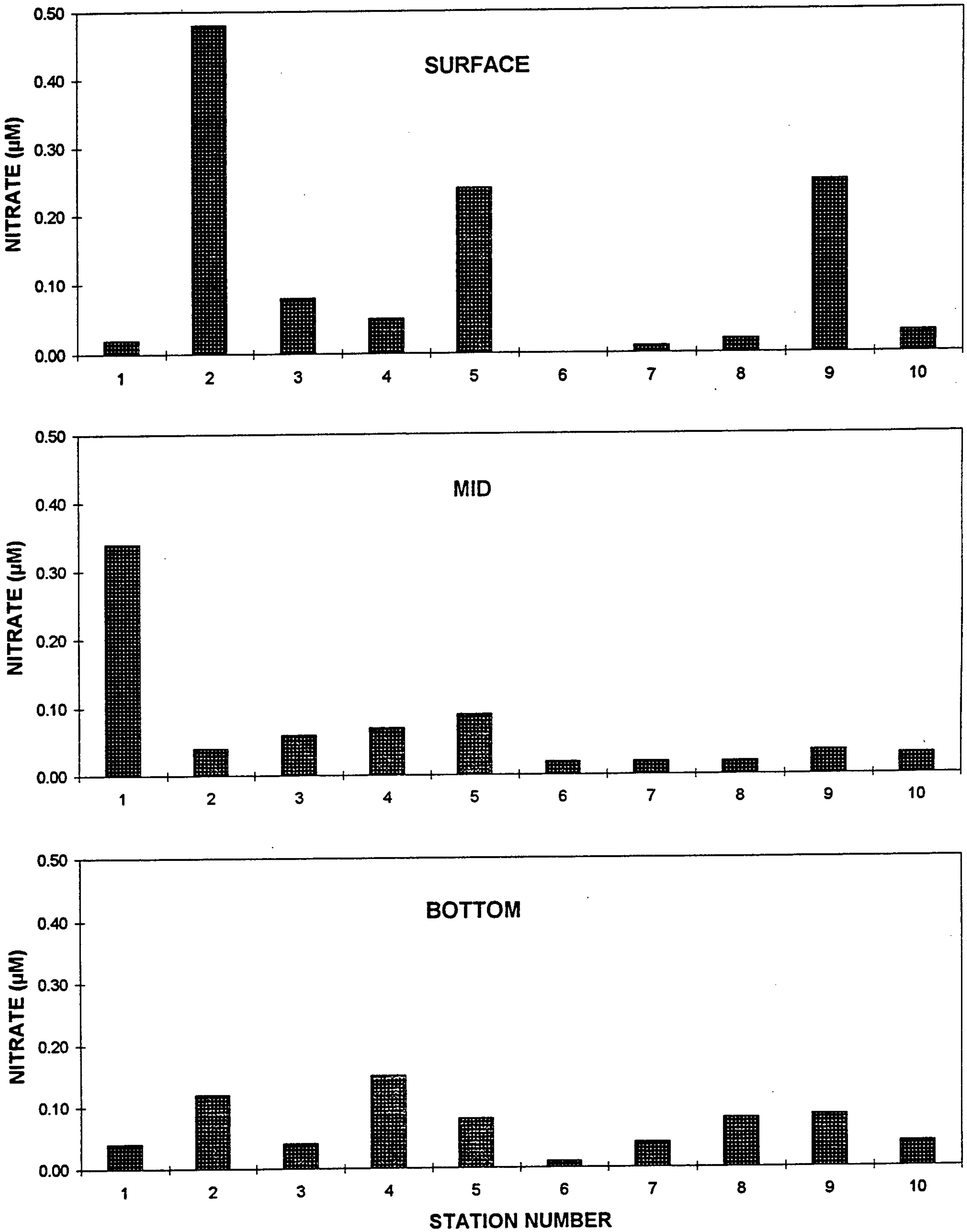

FIGURE 19. Measurements of nitrate in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on October 9, 1997. Absence of data bar indicates sample was below detection limit. For station location, see Figure 1.

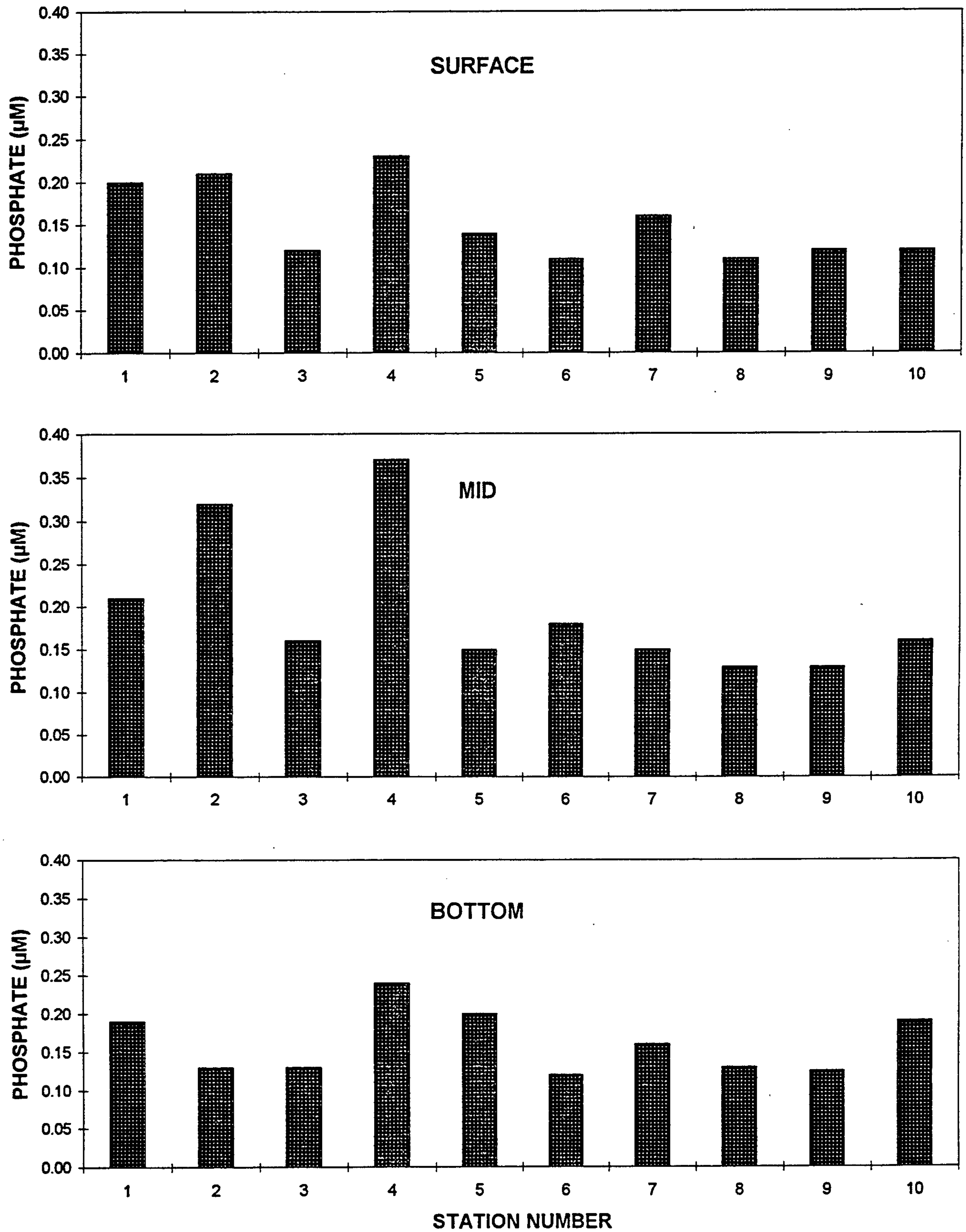

FIGURE 20. Measurements of phosphate in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on October 9, 1997. For station location, see Figure 1.

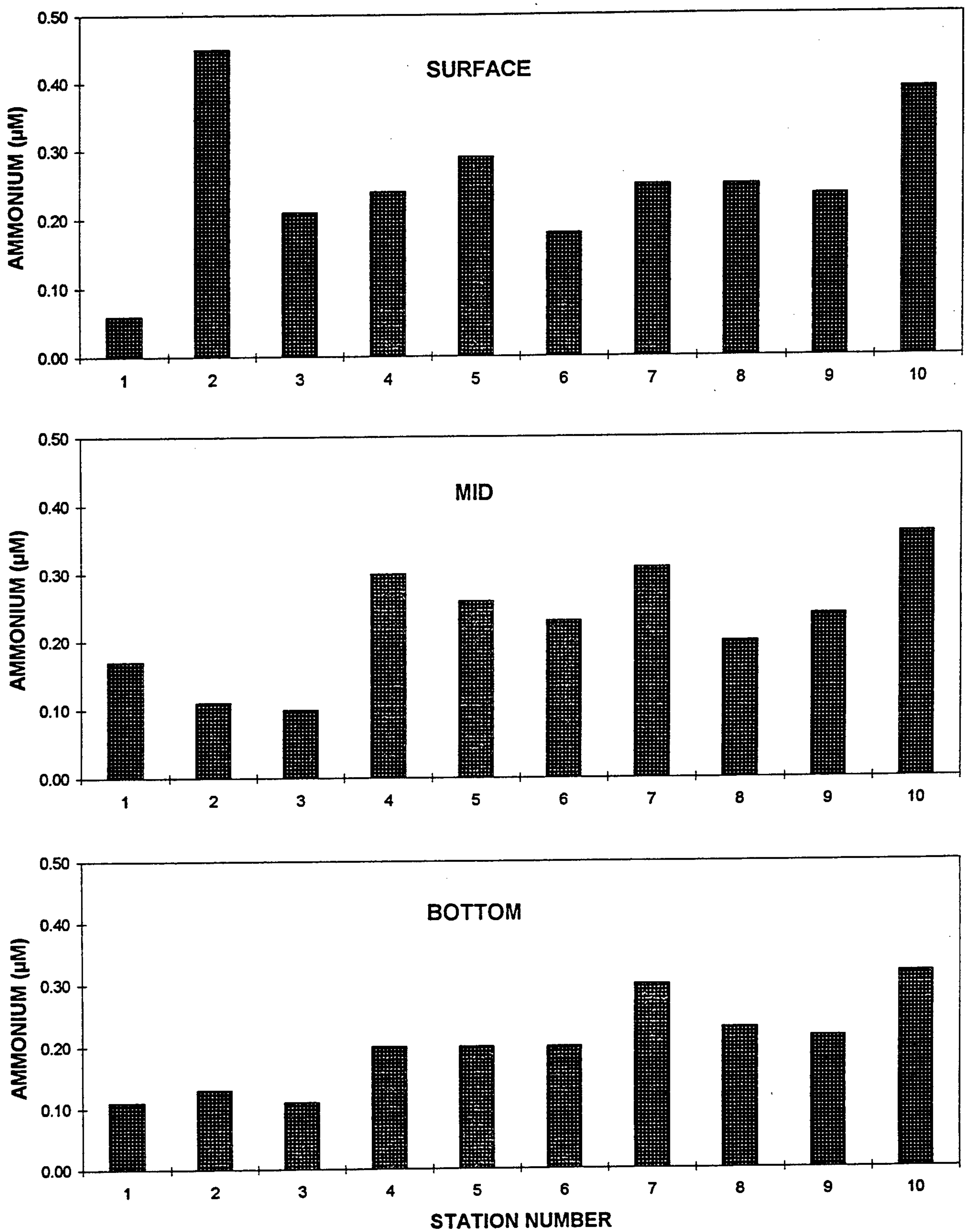

FIGURE 21. Measurements of ammonium in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on October 9, 1997. For station location, see Figure 1.

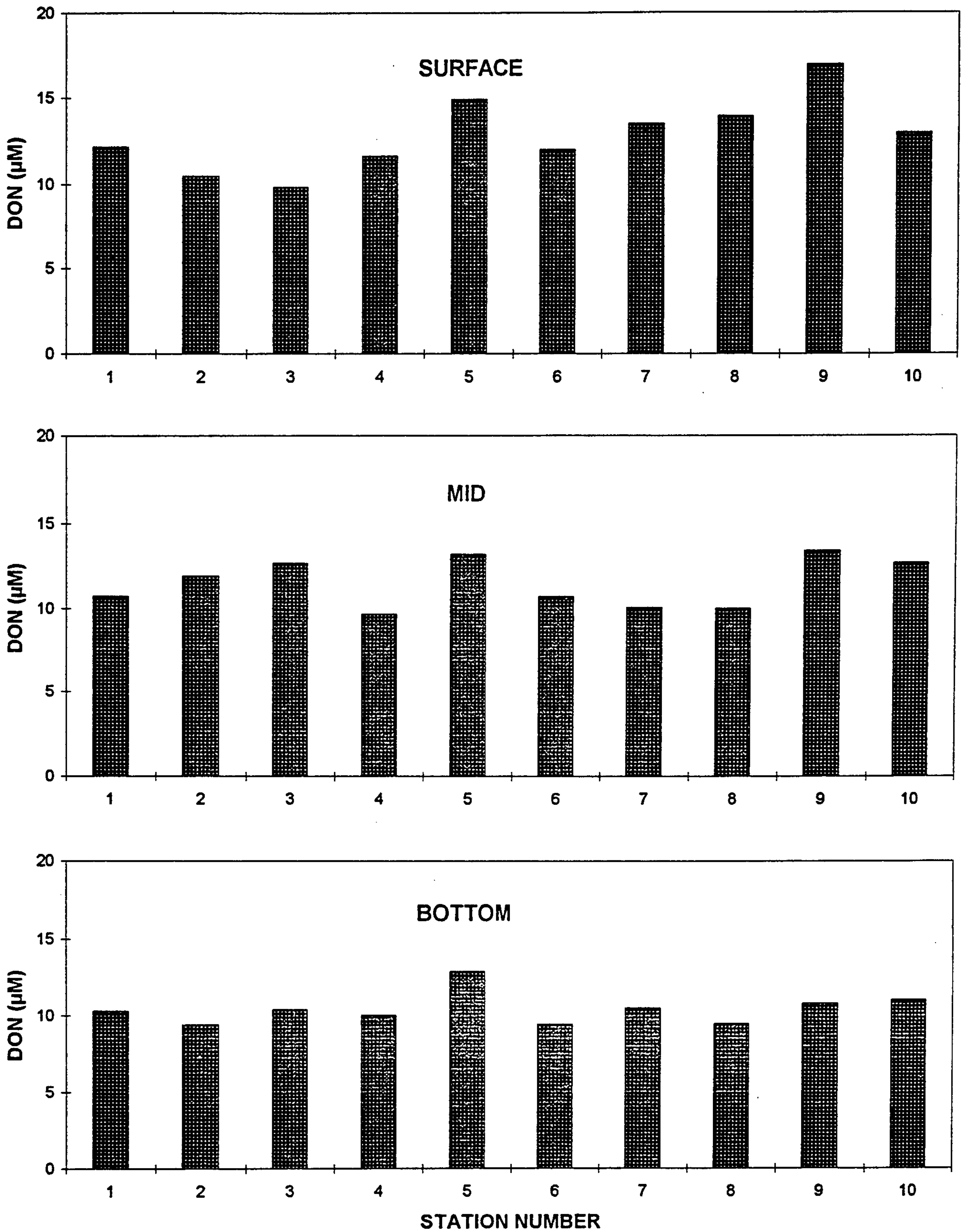

FIGURE 22. Measurements of dissolved organic nitrogen in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on October 9, 1997. For station location, see Figure 1.

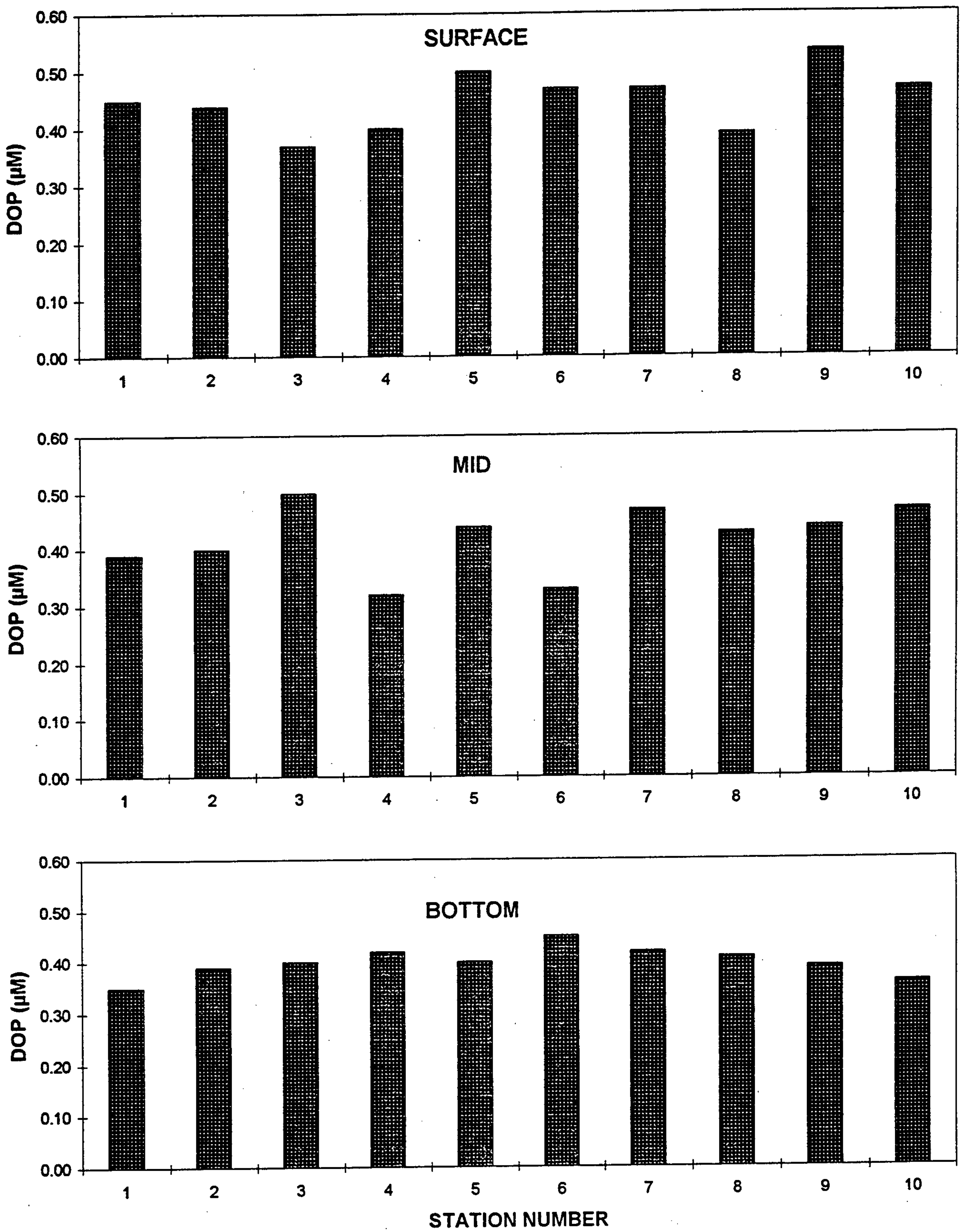

FIGURE 23. Measurements of dissolved organic phosphorus in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on October 9, 1997. For station location, see Figure 1.

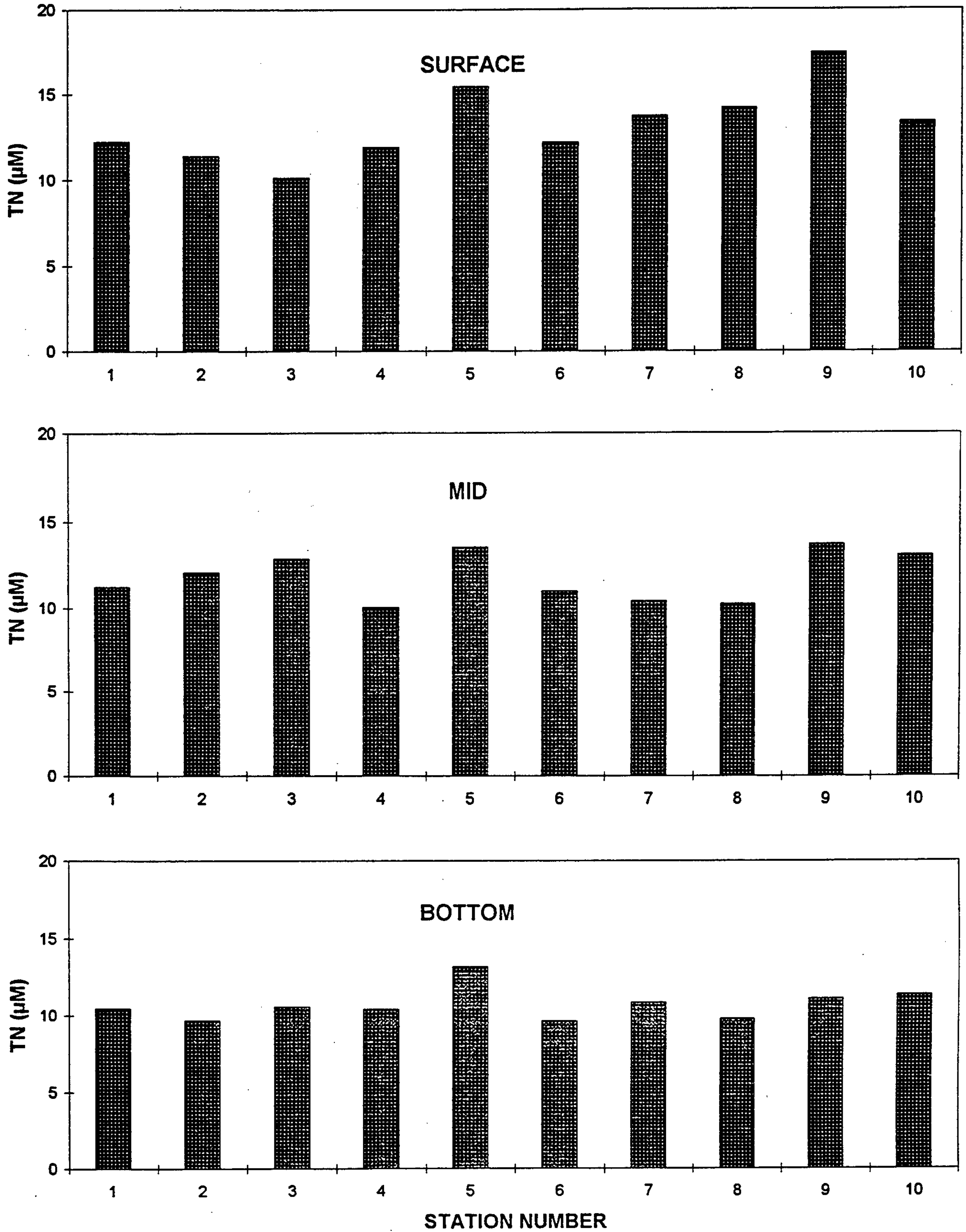

FIGURE 24. Measurements of total nitrogen in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on October 9, 1997. For station location, see Figure 1.

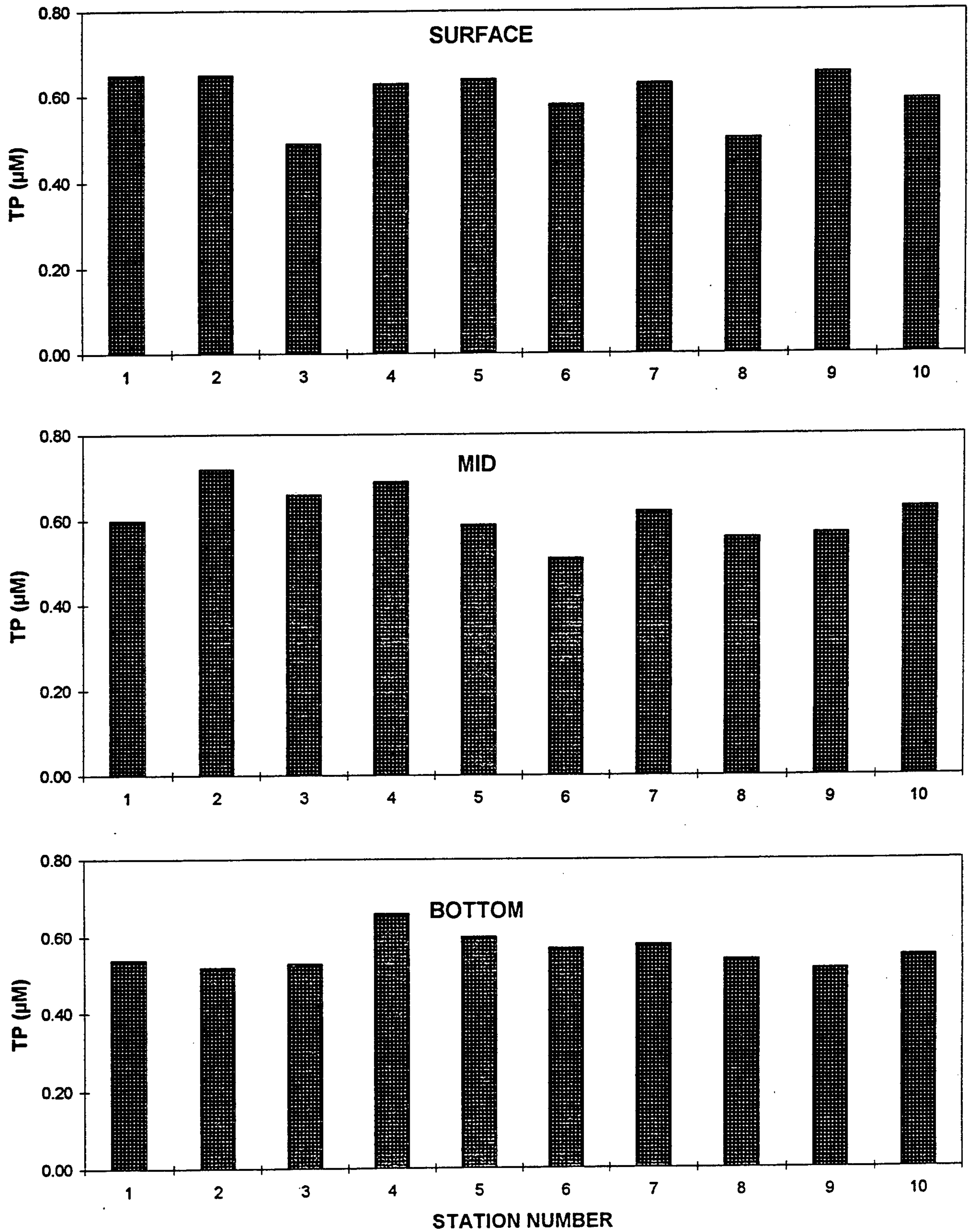

FIGURE 25. Measurements of total phosphorus in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on October 9, 1997. For station location, see Figure 1.

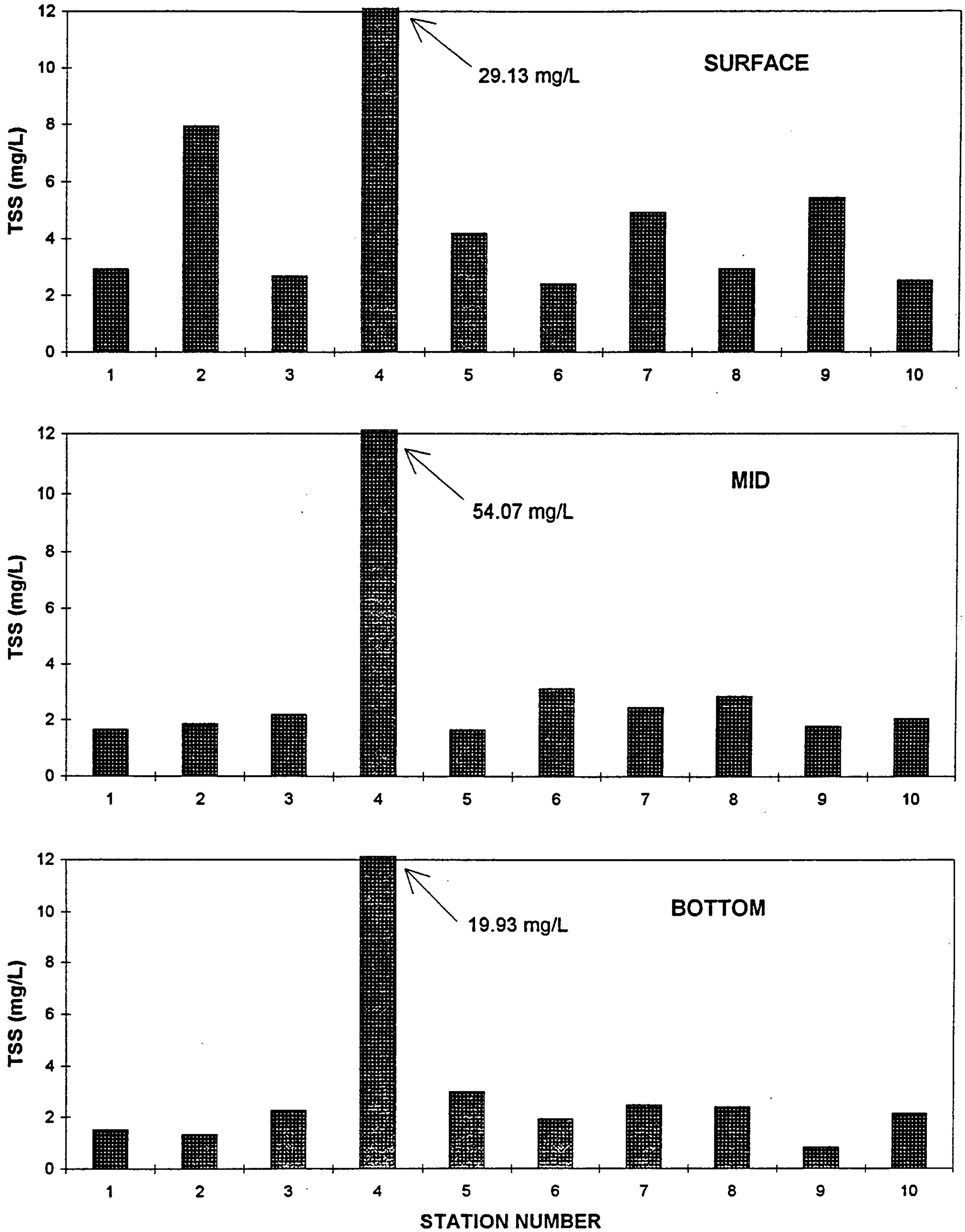

FIGURE 26. Measurements of total suspended solids in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on October 9, 1997. Note: data collected at Station 4 shortly after the passing of a large ship. For station location, see Figure 1.

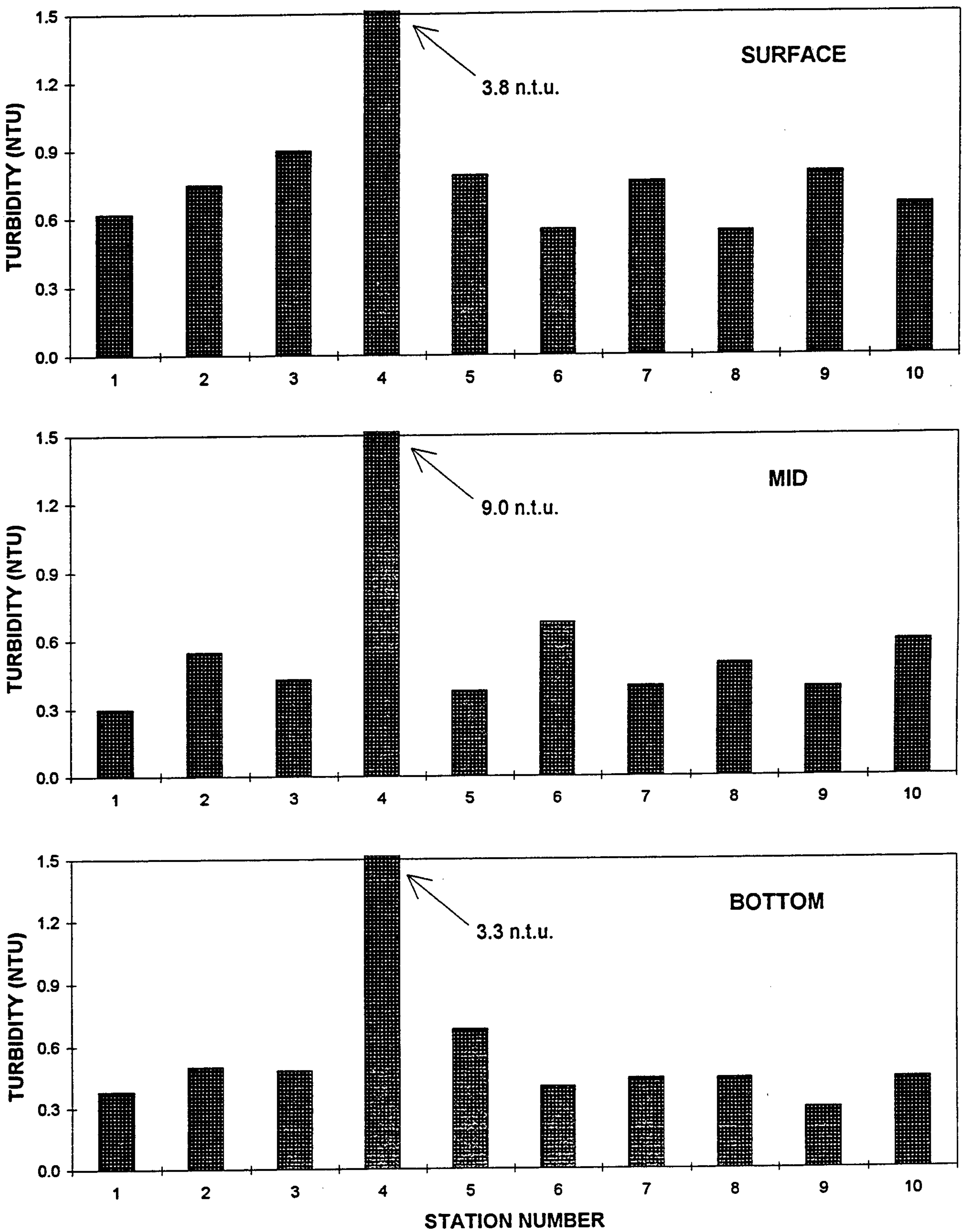

FIGURE 27. Measurements of turbidity in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on October 9, 1997. Note: Data collected at Station 4 shortly after the passing of a large ship. For station location, see Figure 1.

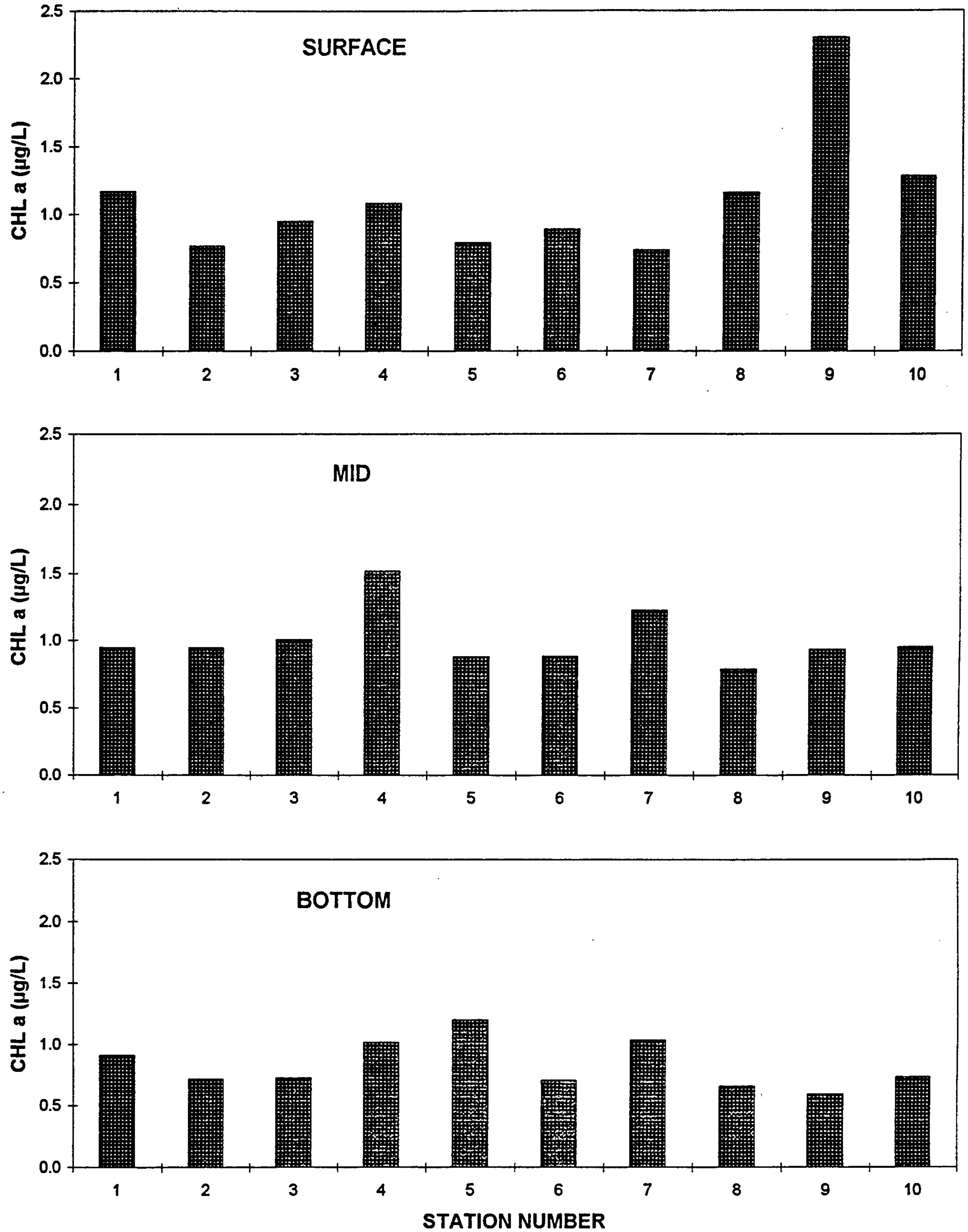

FIGURE 28. Measurements of chlorophyll *a* in surface, mid, and bottom waters from 10 stations in the vicinity of the Aircraft Carrier Homeporting project. Samples were collected on October 9, 1997. For station location, see Figure 1.

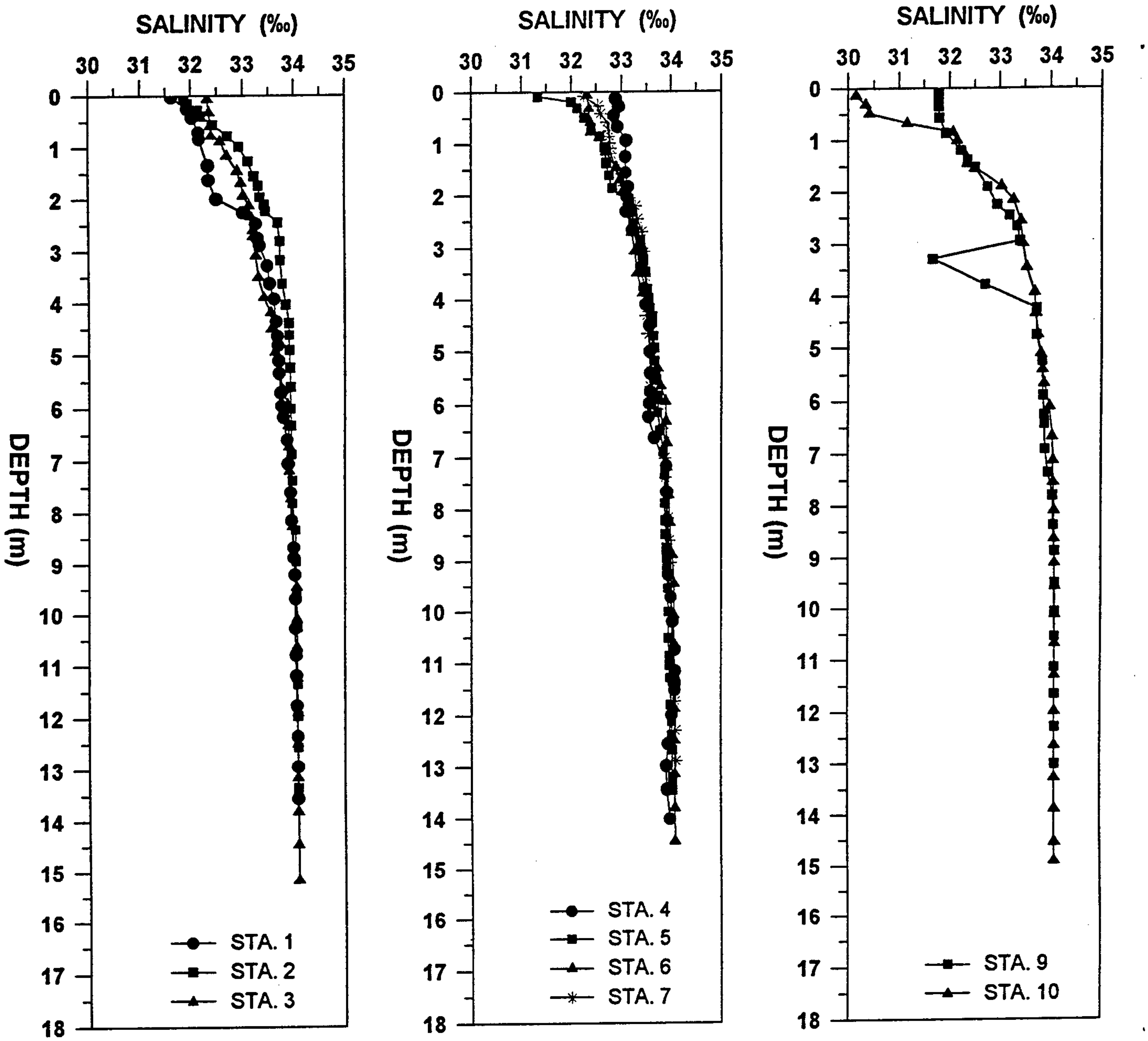

FIGURE 29. Continuous vertical profiles (in parts per thousand) of salinity at 9 stations in the vicinity of the Aircraft Carrier Homeporting project collected on October 9, 1997. Data for Station 8 not available. For station locations, see Figure 1.

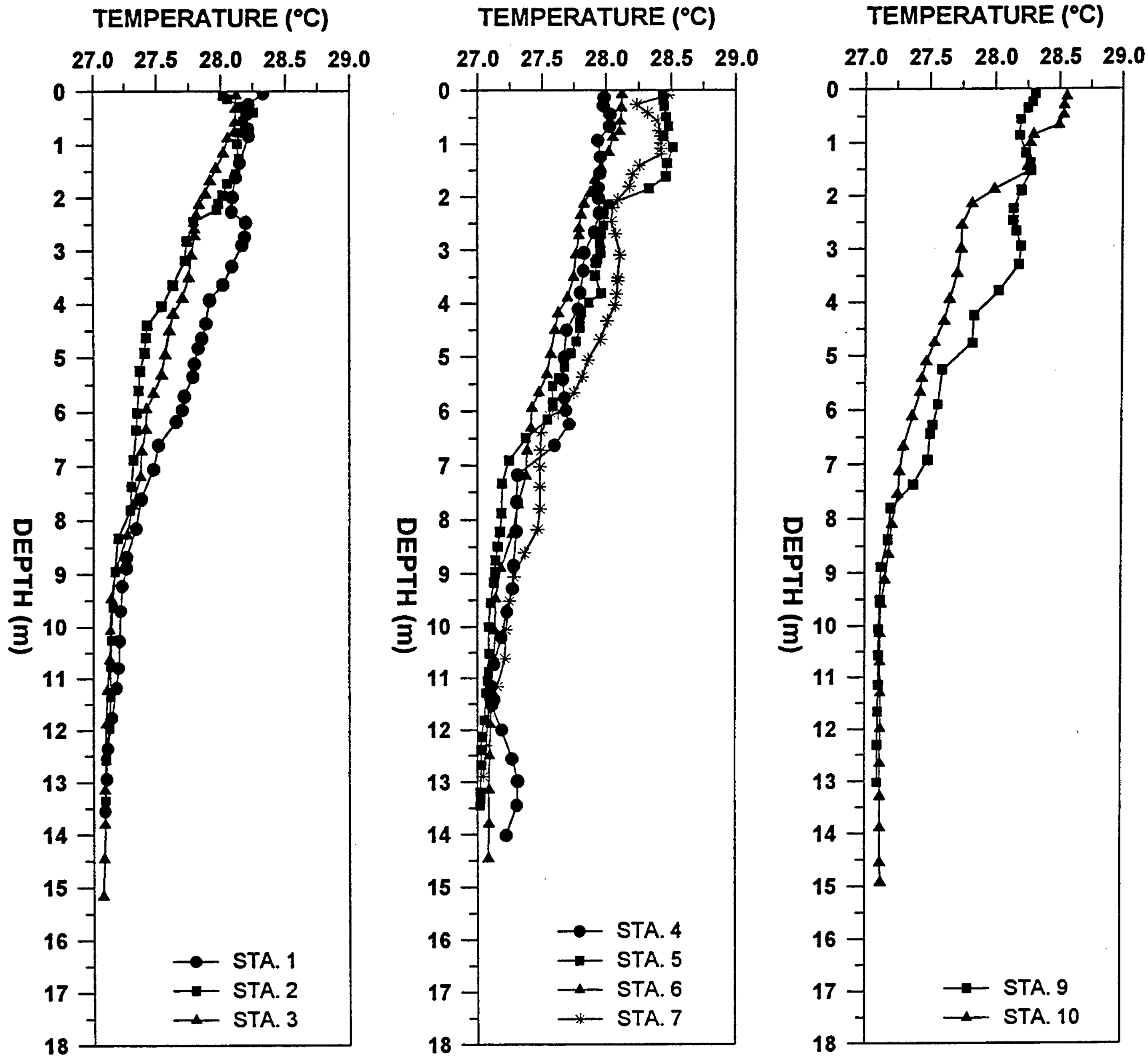

FIGURE 30. Continuous vertical profiles of temperature at 9 stations in the vicinity of the Aircraft Carrier Homeporting project collected on October 9, 1997. Data for Station 8 not available. For station locations, see Figure 1.

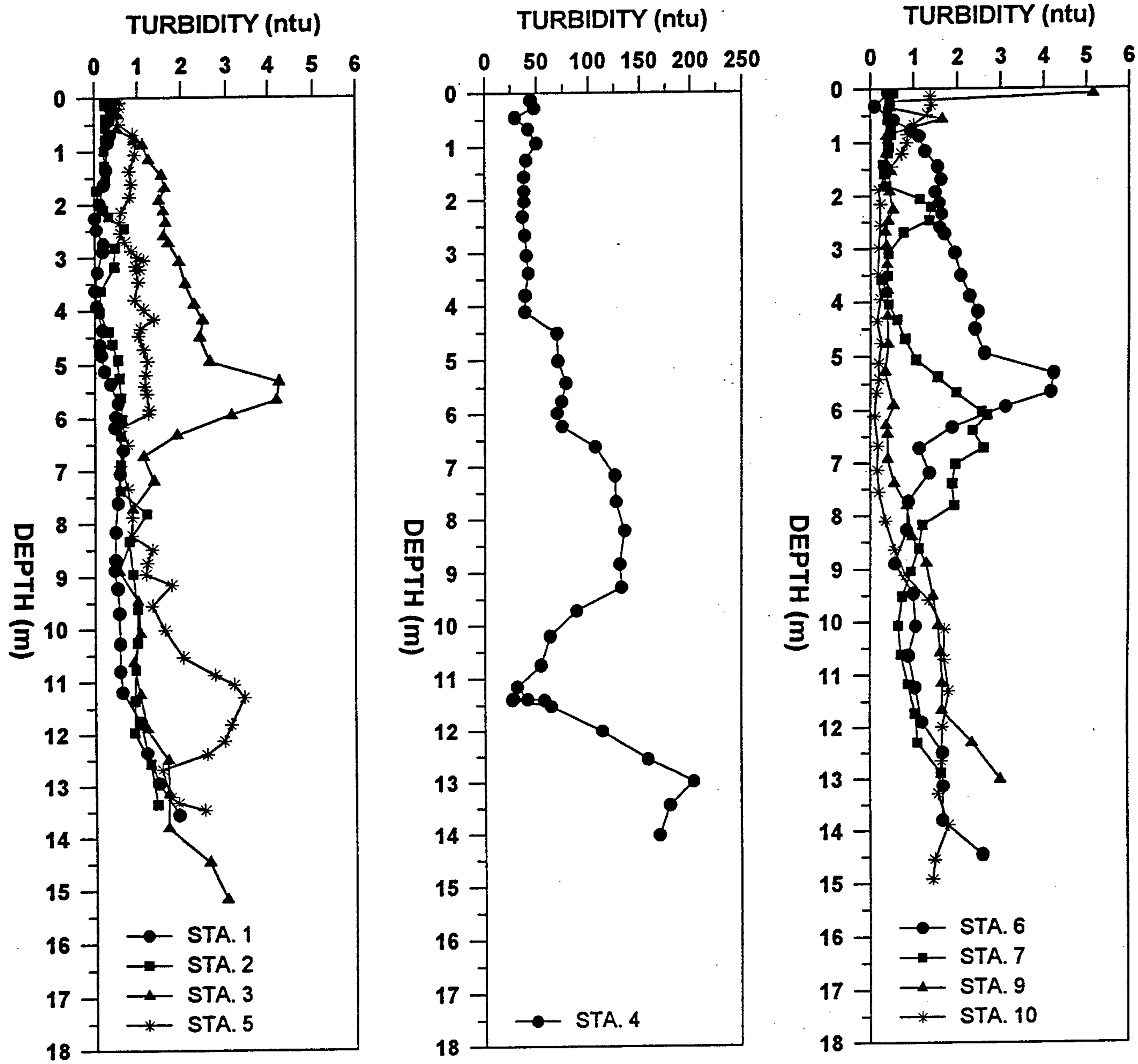

FIGURE 31. Continuous vertical profiles of turbidity at 9 stations in the vicinity of the Aircraft Carrier Home Porting project collected on October 9, 1997. Note y-axis scale change for Station 4 (data collected shortly after the passing of a large ship). Data for Station 8 not available. For station locations, see Figure 1.

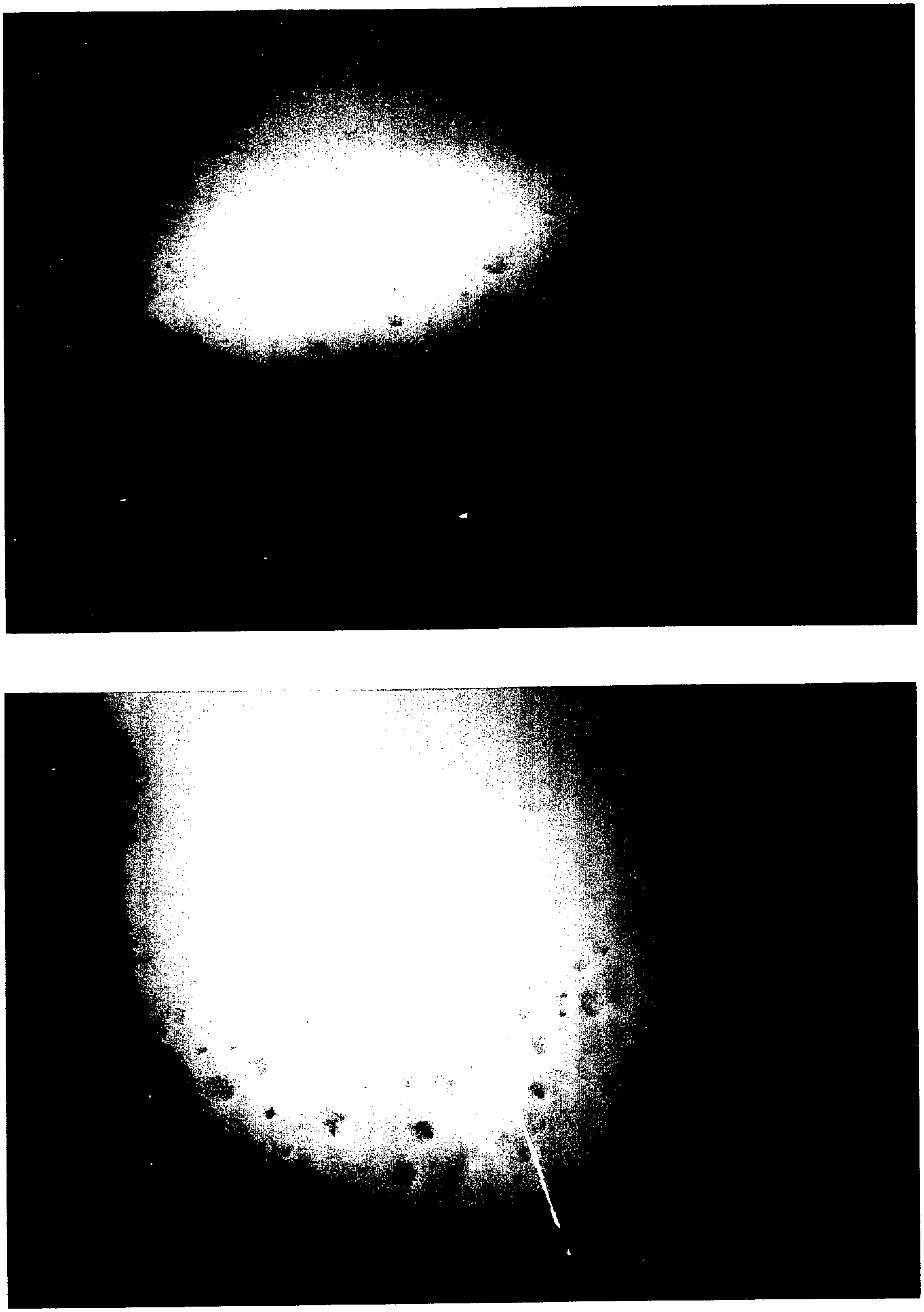

FIGURE 32. Underwater views of floor of Pearl Harbor entrance channel and turning basin showing numerous burrow holes from benthic macroinfauna.

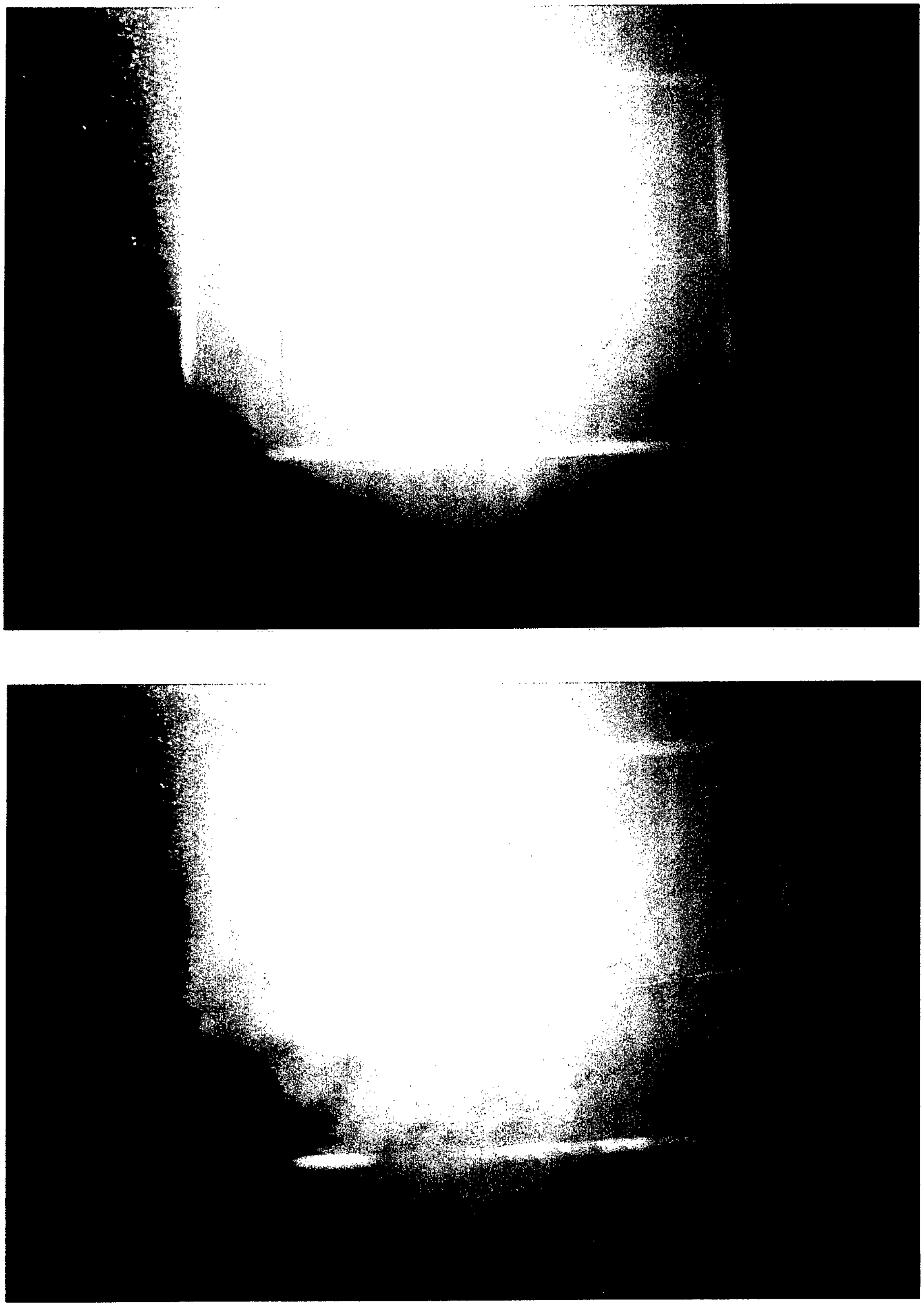

FIGURE 33. Photographs of benthic photo-transect quadrats at Station 10 in Pearl Harbor entrance channel.

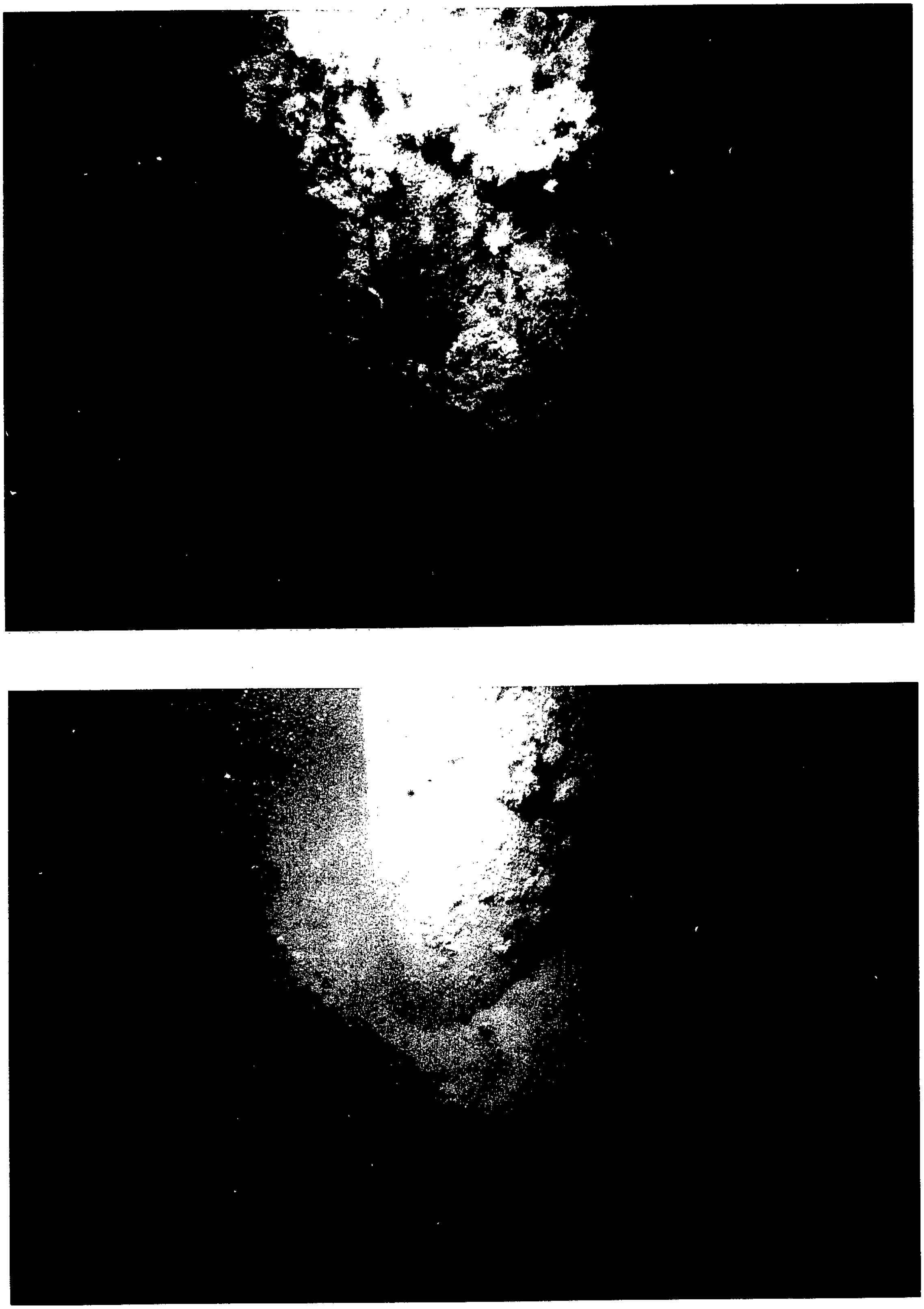

FIGURE 34. Underwater photographs of pilings of Piers B2/B3. Predominant biota is the orange sponge of the genus Microciona.

SECTION 6.4

DATA REPORT, PEARL HARBOR SEDIMENT

Data Report

PEARL HARBOR SEDIMENT

Prepared for
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680 Ala Moana Boulevard
First Floor
Honolulu, HI 96813-5407

Prepared by
MEC Analytical Systems, Inc.

December 1997

TABLE OF CONTENTS

1.0 INTRODUCTION

This project supports impacts analysis associated with an environmental impact statement (EIS) and is not intended to provide data appropriate for an ocean disposal permit application.

Therefore, the objective of this sampling effort was to obtain screening level chemistry and bioassay results for bulk sediment at proposed future dredge sites.

1.1 SAMPLE SITES

The sampling sites consist of areas to be transited or occupied by a NIMITZ-class CVN, i.e.

- berths B2 and B3 in the PHNSY
- the turning basin between berths B2 and B3 and Ford Island
- the inner channel from Bishop Point to Hospital Point

Recent (1995-1996) bathymetric surveys indicated existing depths of about 43 to 50 feet below MLLW in these locations. The project dredge depth would be 50 feet below MLLW; therefore, to allow for two feet of over-dredging, samples were obtained to a depth of approximately 52' below MLLW.

Samples from 10 locations were obtained and a total of 10 composite samples were analyzed.

2.0 FIELD SAMPLING PROCEDURES

A total of 10 project locations were sampled for sediments by coring using an electric vibracore. In addition, one reference site was sampled. Samples were obtained by MEC Analytical Systems Inc. (MEC) of Carlsbad, California; P&R Water Taxi of Honolulu, Hawaii provided the vessel "Hapa" to support the sampling equipment.

2.1 SAMPLE LOCATIONS

Samples from ten locations were obtained from the project area (Figure 1). Multiple cores were taken at some sites to provide sufficient volume for analysis.

- **B2/3.** Core samples from 3 locations were obtained. One location from within 50 feet of each berth (Site 1 at B2 and Site 2 at B3), and a third midway between Sites 1 and 2 and approximately 350 feet from the pier (Site 3).
- **Turning basin.** Four core samples were obtained from the roughly rectangular turning basin, one from the center of each quadrant (Sites 4-7).
- **Inner channel.** Three core samples were obtained from the inner channel. One was obtained off Bishop Point, one approximately 1000 feet north of Waipio Point, and one off the southern end of Ford Island (Sites 8-10).
- **Reference sample.** Carbonate sand was obtained from the subtidal zone offshore of Lanikai beach, on the windward side of Oahu.
- **Control sample.** The matrix from which laboratory animals were collected was used as the control sample in the solid phase bioassay testing.

2.2 NAVIGATION, STATION LOCATIONS AND OPERATIONS

Sample locations were documented using a Magnavox MX200 Differential GPS. A Trimble Pro-Beacon differential receiver utilized the USCG differential signal for the correction. Overall accuracy is rated at 2-5 meters. Repeat readings were taken at stations to assess temporal fluctuations. Readings were averaged when appropriate. Locations are presented as latitude and longitude in the WGS84 system (Table 2-1).

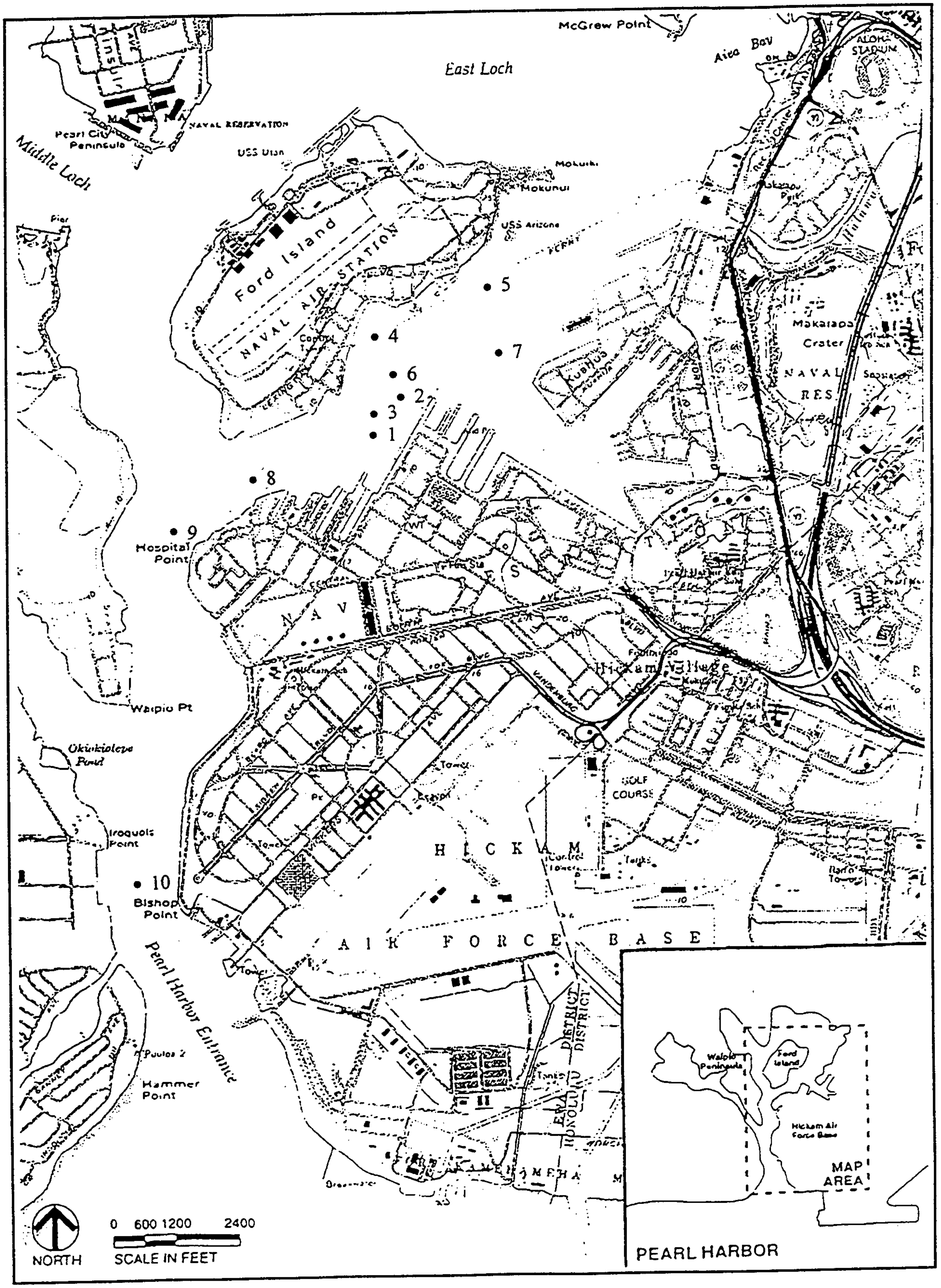
Field Sampling Schedule

Sampling activities took place on 29 October through 1 November, including mob and demob.

Vessel

Field sampling was conducted from the "Hapa", a twin engine 50-foot vessel with a 15 foot beam. The vessel was outfitted with an A-frame/winch, which was used to deploy and recover the vibracore.

Figure 1. Station Locations



Navigation and Positioning

All open-harbor (i.e., turning basin and inner channel) stations were accessed by transiting to the pre-determined station location. A marker buoy was deployed at the target site and a weighted tape measure was used to check the depth. If the depth was less than –50 feet MLLW, then a vibracore sample was collected. If the depth exceeded –50 feet MLLW, then the vessel was moved to an area nearby at a depth of less than 50 feet MLLW. After setting the marker buoy, the stern of the vessel was then maneuvered adjacent to the marker buoy and the equipment was deployed over the stern to collect the sample. Differential GPS (DGPS) positions were logged at the beginning and end of the time during which each core was collected. DGPS positions were also recorded when the buoy was deployed.

Stations 1 and 2 along Berth 2/3 were positioned approximately 50 feet away from the pier and located along the pier using distance marks painted on the pier. Station 1 was taken approximately 50 feet away from the pier and 1,100 feet southwest from the northwest corner of the pier (Berth 2). Station 2 was approximately 50 feet off of the pier and 150 feet southwest from the northwest corner of the pier (Berth 3). Station 3 was located approximately 350 feet away from the pier and 550 feet southwest from the northwest corner of the pier.

2.3 SAMPLE COLLECTIONS

Sample Collection Procedures

The samples were collected using an electric vibratory coring system (vibracorer) provided by MEC Analytical Systems of Carlsbad, CA. The vibracorer is an electric powered sediment sampling system utilizing two electric motors to rotate eccentric weights that vibrate an aluminum head. Attached to the head was a steel core tube; inside the steel tube was a cellulose-acetate-butyrate (CAB) liner. Attached to the penetrating end of the pipe/liner system is a stainless steel cutter/catcher mechanism that traps the sediment in the liner. Core liners were cut to the appropriate length to accommodate sampling to the required project depth plus 2 feet. The core liners were approximately 3.8 inches in inside diameter.

The deployment and retrieval of the coretube and vibracorer was conducted from the vessel in the following manner. First, the vibracorer and coretube of appropriate length were prepared and attached while laid out on the aft deck. The vibracorer was then lifted into a vertical orientation and deployed over the stern using a cable and winch attached to the A-frame. A measuring tape was attached to the vibracorer head to document depth of penetration. The coretube and vibracorer assembly was then lowered to the benthic surface.

When the coretube nose reached the sediment surface, the distance on the measuring tape and the latitude and longitude were noted on the core log form. The vibracorer was turned on and cable was released slowly until the unit reached the intended depth. The distance on the measuring tape was again logged. The time, date, core length and any other pertinent information were recorded in the logbook. Once each core was taken, the coretube/vibracorer assembly was

returned to the deck. The core liner was removed from the outer coretube, and end caps were installed to prevent leakage of core sediments. Each core was kept in a vertical orientation and allowed to sit until disturbed surface sediments settled.

Sample Collection and Handling Procedures

As samples were collected, logs and field notes recorded the following parameters:

- Depth of each coring station as measured from mean lower low water (MLLW). This was accomplished using a weighted line and the NOAA predicted tide charts.
- Date and time of collection.
- Name of field person(s) collecting and logging in the sample.
- The sample station identification number.
- Length of each core section and recovery for each core sample.
- Qualitative notation of apparent resistance of sediment column to coring.
- Any deviation from the approved sampling plan.

Core Extrusion and Logging

The core samples were extruded onto clean polyethylene lined core trays. Pre-cleaned stainless steel utensils were used to manipulate the sediment.

The following information was recorded in the sediment coring logs:

- Date, time, and name of person logging sample.
- Station and sample identification.
- Depth of water at location.
- Sediment sample depth.
- Approximate grain size distribution.
- Color
- Biological structures (e.g., shells, tubes, macrophytes, and bioturbation).
- Presence of debris (e.g., wood chips, wood fibers, other industrial artifacts).
- Presence of oil sheen.
- Odor (e.g., hydrogen sulfide, petroleum hydrocarbons).

Sample Compositing

Sediment core samples exhibited minimal stratification. Samples at Sites 1 and 2 were split between top and bottom to assess temporal changes in deposition of contaminants. For the remaining sites, the entire length of the core to dredge plan depth +2 feet was composited (Table 2-1). All compositing was performed after the core log descriptions were complete. The core sediments were transferred into clean stainless steel bowls and mixed thoroughly using clean stainless steel utensils. The samples were aliquoted for chemical characterization, physical properties and bioassay testing.

Table 2-1, Compositing Scheme

SAMPLE ID	LOCATION	DESCRIPTION
1-2 T	Adjacent to Pier B2/3	Composite of upper halves from two stations (Sites 1 and 2) obtained adjacent to Pier B2/3
1-2 B	Adjacent to Pier B2/3	Composite of lower halves from two stations (Sites 1 and 2) obtained adjacent to Pier B2/3
3	Adjacent to Pier B2/3	Vertical composite of one core location (Site 3) obtained adjacent to Pier B2/3
4 - 7	Turning Basin	Vertical composite of each of four cores obtained from the turning basin
8 -10	Inner channel	Vertical composite of each of three cores obtained from the inner channel

Decontamination

All sampling core liners were thoroughly cleaned prior to use according to the following procedure:

- Wash with brush and Alconox ™ soap.
- Rinse with seawater.
- Rinse with distilled water.
- After cleaning, immediately place the core liners inside the core tube.

Compositing and sampling equipment, (e.g., mixing bowls and compositing utensils) was cleaned according to the following procedure:

- Wash with brush and Alconox ™ soap.
- Rinse with potable water.
- Rinse with distilled or deionized water.
- Rinse with pesticide grade Methanol.
- Rinse with pesticide Hexane.

Sampling equipment was kept uncontaminated by enclosing the bowls and utensils in clean polyethylene bags prior to use. Clean latex gloves were worn during all sediment manipulations to prevent contamination.

Sample Transport and Chain-of-Custody

After compositing, samples aliquoted for chemical characterization were placed in precleaned containers provided by the chemistry laboratory. Samples for bioassay and physical testing were placed in polyethylene bags, air removed, and sealed. All sediment samples were placed in ice chests with wet ice and held at approximately 4° in darkness. The samples were batch shipped to the laboratories at the conclusion of field sampling

Specific procedures were as follows:

- Sample bottles were clearly labeled with sample station and number, date and time of collection, type of analysis, and sampler's initials.
- All samples were documented on a Chain of Custody (COC). The COCs were enclosed in the cooler with the samples and sent to the laboratory for analysis. The field team retained copies of the COCs.
- Samples were packaged and shipped in accordance with USDOT regulations. Sample bottles were placed in coolers with wet ice and packed with bubble wrap to prevent breakage.
- The coolers were clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the cooler and recipient's office name and address) to enable positive identification.
- A sealed watertight envelope containing COC forms was enclosed in the cooler.
- Signed and dated chain-of-custody seals were placed on all coolers prior to shipping.
- Coolers were taped securely with duct tape or other packing tape to prevent them from breaking open during shipment.

2.4 FIELD QA/QC PROCEDURES

Field sampling. The field sampling quality assurance objectives were met by MEC Analytical Systems Inc. Internal MEC Standard Operating Procedures (SOPs) define vibracore sampling, sample preservation and shipping, and Chain of Custody systems. Sample logs were completed in ink. Copies of the sample logs are presented in Appendix A. A photographic record of each core is presented in Appendix B.

3.0 LABORATORY PROCEDURES

Physical analyses were performed by MEC Analytical Systems Inc. of Carlsbad, California. Analytical chemistry was performed by Columbia Analytical Services of Kelso, Washington. Toxicity testing was performed by Ogden Environmental of San Diego, California.

3.1 LABORATORY ANALYSES

Physical and chemical analyses. Test and reference sediments were analyzed for the standard suite of Tier III parameters detailed in the Evaluation of Dredged Material Proposed for Ocean Disposal Testing Manual ("Green Book", EPA/ACOE, 1991). The target analytes were 13 priority pollutant metals, polychlorinated biphenyls (PCBs), pesticides, phenols, TRPH (total recoverable petroleum hydrocarbons), polynuclear aromatic hydrocarbons (PAHs), organic tin, total sulfides, ammonia, total organic carbon, and particle size. In addition to the "Green Book" list of analyses, the Toxicity Characteristic Leaching Procedure (TCLP) method was performed on 13 metals to evaluate upland disposal options.

Bioassays. Two bioassay-screening tests were performed for test and reference samples: a solid phase (SP) test (amphipod) and a suspended particulate phase (SPP) test (bivalve larva). Percent survival of individuals by replicate after ten days was calculated for the solid phase test. Percent survival and percent normal development of larvae to the "d-hinge" stage was calculated for the liquid/suspended phase test. Analysis of each test matrix compared individual samples to the reference sediment data using the t-test statistic.

3.1.1 Procedures: Physical and Chemical Analyses

Physical properties. Tests to characterize the physical properties of the sediments were performed to predict the behavior of sediments after disposal and to compare reference and test sediments. Physical analyses of the dredge material included grain size, total organic carbon (TOC), and total solids.

- Grain size analysis determined the percentages of the general size classes that make up the sediment (gravel, sand, silt, and clay). Gravel and sand fractions were separated using nested sieves; silt and clay fractions were separated using the gravimetric/pipette method (Plumb 1981).

- TOC, made up of volatile and nonvolatile organic compounds, was determined by EPA Method 9060. Sediments were treated with hydrochloric or sulfuric acid to remove the inorganic carbon (carbonates and bicarbonates) prior to TOC analysis (Plumb, 1981).

- Total solids were determined by weighing the organic and inorganic material remaining in a sample after it was dried at a specific temperature. Total solids were measured and used to convert concentrations of the chemical parameters from a wet-weight to a dry-weight basis.

Chemistry. Sediment chemistry was used to identify and quantify the concentrations of contaminants within sediments proposed for dredging and ocean disposal. The test sediments and reference sediments were examined for the list of chemicals shown in Table 1 of the SAP, based upon information presented in the Draft Regional Implementation Manual (RIM) for the State of Hawaii (ACOE/EPA, 1997).

Analytical methods were EPA Methods recommended in the Green Book and shown in the tables in Section 4. Organic tin analysis used methodology described in Krone et al., 1988. Porewater was analyzed for ammonia and sulfides using standard laboratory water quality meters and ion selective electrodes (Orion SA-720). Procedural blanks, reagent blanks, and standard reference materials were analyzed, and results are incorporated into a discussion of the analytical quality assurance and control parameters.

3.1.2 Procedures: Solid Phase Bioassay

Solid phase bioassays were used to estimate the potential impact of ocean disposal on benthic infauna. Sediment was evaluated using the 10-day solid phase test with the amphipod *Grandidierella japonica*. Prior to bioassay testing, ammonia (ion selective electrode), sulfides (photometric) and salinity (conductivity probe) were measured within interstitial water from reference, test, and control sediments. Sediments were press sieved through a 2.0-mm mesh to remove organisms, using only the water available in the sediment sample. Each sediment type (test, reference and control) was tested with five laboratory replicates. Control sediment was obtained from the area the *G. japonica* were collected.

Experiments were conducted in 1-liter glass test chambers containing a single 2-cm layer of test, reference or control material. Overlying water was renewed every other day. Initial stocking densities were 20 amphipods in each replicate. Aeration was provided through plastic pipettes, with care taken to avoid disturbing the sediment. Water quality measurements (pH, salinity, temperature and dissolved oxygen) were taken in one replicate from each test treatment daily. Ammonia was measured at the start and finish of the test for each sediment type. All instruments were calibrated and logged daily prior to use. After 10 days, the animals were carefully sieved from the sediments and counted.

Statistical methods described in the Green Book were utilized to determine if significant mortality occurred. Control survival was required to be equal to or above 90 percent for the test to be considered valid. To evaluate the relative sensitivity of the organisms, reference toxicity tests were conducted using standard reference toxicants (Lee, 1980).

3.1.3 Procedures: Suspended-Particulate Phase Bioassays

Suspended-particulate phase (SPP) bioassay tests were used to estimate potential impacts of ocean disposal on organisms living in the water column. The SPP tests were performed according to the Green Book using a 4:1 dilution of seawater to test sediment. The species tested was the bivalve larvae (*Crassostrea gigas.*). The bivalve larva test was performed on the test

sediment elutriates at concentrations of 0, 1, 10, 50 and 100 percent. The test (ASTM, 1992) was run for 48 hrs.

The ASTM method requires a test criterion of 70 percent survival of normally developed D-hinge larvae in the control treatment. At the termination of the study, point estimate statistical techniques (e.g., LC_{50} and EC_{50}) were used to analyze the results.

3.2 LABORATORY QA/QC PROCEDURES

Quality assurance procedures to be used for sediment testing were consistent with methods described in the Green Book. All samples were tracked using chain-of-custody sheets and sample receipt logs. Sample storage conditions and holding times were adhered to strictly.

3.2.1 QA/QC for Chemistry Analyses

Chemistry. For trace chemical analysis, the procedures included documentation of the following criteria for each sample matrix type: analytical reproducibility, analytical detection limits, recovery of *in situ* metals and organics, and COC documentation.

The quality assurance objectives for chemical analysis conducted by Columbia Analytical Sciences (CAS) are detailed in their laboratory QA manual. These objectives for accuracy and precision involve all aspects of the testing process, including:

- Calibration methods and frequency
- Data analysis, validation, and reporting
- Internal quality control
- Preventive maintenance
- Procedures to assure data accuracy and completeness

Laboratory QC samples. Environmental sample matrix spike and matrix spike duplicate analyses were performed at a rate of ≥5%. Method or reagent blanks were analyzed at a frequency of ≥5% or for every analytical batch, whichever was greater. In the absence of adequate sample quantity to perform matrix spiking for all matrix types, either the imaginary matrix as described in SW-846 or laboratory water was used for preparing matrix spikes. Matrix spikes are an environmental sample, which is split into three separate aliquots, and one aliquot is analyzed free from matrix spike introduction. A known concentration of the analyte of interest is added to the other two aliquots prior to sample preparation and analysis. Both percent recovery and relative percent difference are reported for matrix spikes/matrix spike duplicates. Spike data can provide an indication of matrix bias or interference on analyte recovery. Duplicate data can provide an indication of laboratory precision.

Results of all laboratory QC analyses are reported with the final data, and are presented in Appendix C and D. Any QC samples that failed to meet the QC criteria specified in the methodology or in the SAP are identified and the corresponding data appropriately flagged. All

Quality Assurance/Quality Control records for the various testing programs will be kept on file for review by regulatory agency personnel.

3.2.2 QA/QC for Bioassays

The quality assurance objectives for toxicity testing are those detailed in U.S. EPA (1985a, 1985b) and the Green Book (EPA/COE, 1991). These objectives for accuracy and precision involve all aspects of the testing process, including: (1) water and sediment sampling and handling; (2) source and condition of test organisms; (3) condition of equipment; (4) test conditions; (5) instrument calibration; (6) use of reference toxicants; (7) record keeping; and (8) data evaluation. The methods employed in the toxicity testing program are detailed in Ogden's Laboratory SOPs and specific test protocols. These SOPs have been audited and approved by an independent, EPA recommended laboratory and placed in the QA files, as well as in laboratory files. All Ogden laboratory staff receives regular documented training in SOPs and test methods.

A reference toxicant was tested on each test organism during the test period to establish the validity of the toxicity data. For those species with substantive reference toxicant data available, the LC_{50} and EC_{50} should fall within two standard deviations of the laboratory mean. Water quality measurements were monitored to ensure they fell within prescribed limits, and corrective actions (EPA recommended) were taken if necessary. All limits established for this program met or exceeded those recommended by EPA.

Data collected and produced as a result of analysis was recorded on approved data sheets that are part of the permanent data record for the program.

If any aspect of a test deviated from protocol, the test was evaluated to determine whether it was valid according to the relevant regulatory agencies and the clients. If it was determined to be unacceptable, the client was notified, and the test was repeated.

Data Analysis, Validation and Reporting. All acute and chronic toxicity tests were performed according to protocols and conditions listed in Ogden's test protocols. Raw data and study records were checked to ensure that required test conditions were within specifications cited in the SOPs. Major deviations from protocol required approval from both the client and the quality control manager. Unforeseen circumstances that may have affected the integrity of the study are reported with the test results. The data, analysis and report were also reviewed for accuracy by the Quality Control Manager.

Internal Quality Control. Ogden's quality control staff performed periodic audits to ensure that test conditions, data collection and test procedures were conducted according to Green Book and Ogden protocols. Animal receipt and maintenance logbooks were used to record the source and health of organisms. Reference toxicant tests were used for an internal check on organism health and performance.

Preventive Maintenance. Key analytical equipment is maintained routinely to ensure that equipment failure or changes in operational parameters can be prevented. Procedures used to maintain equipment are included in the Maintenance and Calibration Log. Replacement parts are

available for commonly expected repairs and replacement. Spare parts include pH electrodes, dissolved oxygen (DO) probe membrane replacement kits, calibrated thermometers, pipettes, graduated cylinders, etc.

Stock standard solutions were stored in at least two separate containers, so that a fresh standard solution is available in case the stock standard currently in use becomes contaminated. Working standards, which are in frequent contact with electrodes, pipettes, etc. were kept in separate working bottles to reduce chances of contamination of stock standards.

Procedures Used to Assess Data Precision, Accuracy, and Completeness. The precision of the reference toxicant LC_{50} determinations are shown by calculating the 95 percent confidence intervals. The computer program used to analyze the data is designed in such a way that, regardless of the data characteristics, it will calculate an LC_{50} and corresponding confidence intervals as long as sufficient mortality is observed. Accuracy cannot be determined as a true value but rather must be determined relative to a reference value of the substance being measured.

The precision of all the analytical instruments (DO meter, pH meter, balances, etc.) is assumed to be that stipulated by the manufacturer. The accuracy of the measurements is assessed through daily calibration.

4.0 RESULTS

Sediments from Pearl Harbor were collected and analyzed to determine the magnitude and spatial extent of chemical contamination within material proposed for dredging and ocean disposal. The study included chemical analysis of sediment samples for metals, PAHs, PCBs, pesticides, phenols, organic tin, sulfides, ammonia. To address the alternative of upland disposal of sediments, TCLP extraction and metal analysis of the extract was performed. The physical parameters particle size, TOC, and percent solids were also measured. Two common dredge sediment characterization tests were performed, the solid phase (SP) 10 day acute amphipod test and the suspended particulate phase (SPP) 48 hour bivalve larvae survival and development test.

4.1 FIELD RESULTS

Field sampling was performed on 30 and 31 October 1997. Table 4-1 summarizes the field core log locations, water depths and sample lengths. Information from the first acceptable core is presented. Information on additional cores collected for bioassay volume is included in Appendix A.

Table 4-1 Core Log Summary

STATION ID	LATITUDE (DEGMIN, WGS84)	LONGITUDE (DEGMIN, WGS84)	WATER DEPTH (FT MLLW)	TARGET CORE LENGTH (FT)	FINAL CORE LENGTH	# OF CORES
1	21° 21.272'	157° 57.382'	44.5	7.5	4.0	3
2	21° 21.399'	157° 57.300'	45.6	6.4	6.4	1
3	21° 21.368'	157° 57.380'	45.5	6.5	6.5	1
4	21° 21.560'	157° 57.335'	46.8	5.2	5.2	2
5	21° 21.792'	157° 57.067'	45.7	6.3	4.5	2
6	21° 21.475'	157° 57.335'	48.6	3.4	3.4	2
7	21° 21.555'	157° 57.019'	44.8	7.2	7.2	1
8	21° 21.163'	157° 57.865'	43.9	8.1	8.1	1
9	21° 20.976'	157° 58.082'	47.4	4.6	4.4	3
10	21° 19.924'	157° 58.168'	48.0	4.0	4.0	2

Refusal was not encountered at any of the sites. Retrieval was slightly reduced at site 9. Sample compression and liquefaction were the most likely causes of the reduced retrieval. At sites 1 and 5, significant amounts of reduced retrieval after complete penetration were encountered. The most likely mechanism for limited retrieval at Sites 1 and 5 was presumed to be blockage of the core tube by coral fragments or rocks, combined with loose sediments. In loose sediments, the coral/rocks plug the core tip and push sediment away from the core tip instead of into the tube. Multiple attempts at several locations at sites 1 and 5 resulted in consistent low recoveries.

4.2 CHEMISTRY RESULTS

Physical chemistry results are presented in Section 4.2.1. Analytical chemistry results are presented in Section 4.2.2. Results of TCLP analysis are presented in Section 4.2.3. The abbreviation ND refers to "not detected". However, data with the value of "ND" are more accurately quantified as "less than the MRL (Method Reporting Limit)".

4.2.1 Physical Chemistry

Summary data for physical chemistry are presented in Table 4-2. Original laboratory reports are provided in Appendix C.

Table 4-2 Grain Size, TOC, Percent Solids

STATION ID	%GRAVEL	% SAND	% SILT	% CLAY	TOC (%)	% SOLIDS
1-2T	0	11	41.3	47.7	1.050	47
1-2B	0	10	40.1	50	0.875	59
3	0	2.7	46.5	50.9	0.909	43
4	0	4.2	34.9	60.9	0.980	49
5	0	22.4	38.7	38.9	0.650	53
6	0	5.3	39.2	55.4	0.924	46
7	0	21.6	30.8	47.6	0.933	54
8	0	42.5	33.2	24.3	0.403	63
9	0	23.4	44.8	31.8	0.693	51
10	0	44.8	31.9	23.4	2.831	69
Reference	0	97	1.1	1.9	0.127	76

4.2.2 Analytical Chemistry

Summary data for analytical chemistry are presented in Table 4-3. Chemistry laboratory reports are provided by CAS and are presented in Appendix D.

Sediments from the 1-2T in general contained the highest levels of the chemicals analyzed. Of the metals, lead, copper and zinc were present within the 1-2T sample at levels that are sometimes associated with toxicity. The high zinc level measured at 1-2T may have been associated with one or more chips from cathodic protection devices used on ships. Elemental metal material is not typically available to biological organisms, and is not easily associated with toxicity. Of the organic chemicals, PAHs and PCBs were also measured within the 1-2T sample at levels that at times have been associated with biological effects.

Table 4-3

Total Metals											
EPA Method 6010/200.8 (Mercury = EPA Method 7471)											
Units mg/Kg (ppm)											
Analyte	**1-2T**	**1-2B**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Ref.**
Antimony	1	0	0	0	0	0	0	0	0	0	0
Arsenic	8	8	6	5	3	4	5	4	7	4	2
Beryllium	0	0	0	0	1	0	0	0	0	0	ND
Cadmium	1	1	0	0	0	0	0	0	0	0	0
Chromium	88	66	73	70	87	64	70	25	86	32	9
Copper	212	98	68	40	56	38	24	12	41	10	3
Lead	208	67	36	20	33	19	2	7	30	68	1
Mercury	2	2	1	0	1	0	0	0	1	0	ND
Nickel	39	41	41	40	48	40	45	23	49	24	21
Selenium	2	2	ND	ND	1	1	1	ND	1	ND	ND
Silver	1	0	1	0	0	0	0	0	1	0	0
Thallium	0	0	0	0	0	0	0	0	0	0	ND
Zinc	1450	106	95	76	115	72	41	25	83	165	6
Sulfide, Dissolved	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Base Neutral/Acid Semi-volatile Organic Compound											
EPA Method 8270, PAHs and Phenols											
Units Ug/Kg (ppb)											
Analyte	**1-2T**	**1-2B**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Ref.**
Phenol	67	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Base Neutral/Acid Semi-volatile Organic Compound											
EPA Method 8270, PAHs and Phenols											
Units Ug/Kg (ppb)											
Analyte	**1-2T**	**1-2B**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Ref.**
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Chloro-3-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	27	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dimethyl Phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	107	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	136	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Diethyl Phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methyl-4,6-dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	2300	44	21	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	700	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-butyl Phthalate	56	ND	32	37	ND	15	41	22	48	ND	20
Fluoranthene	5100	109	78	26	38	21	ND	ND	55	ND	ND
Pyrene	4300	140	87	30	48	23	ND	ND	71	ND	ND
Butyl Benzyl Phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benz(a)anthracene	2100	46	50	ND	ND	ND	ND	ND	37	ND	ND
Chrysene	2100	53	64	22	27	22	ND	ND	45	ND	ND
Bis(2-ethylhexyl) Phthalate	360	ND	240	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl Phthalate	ND	ND	ND	ND	ND	ND	ND	38	ND	ND	ND
Benzo(b)fluoranthene	2100	129	200	92	151	83	ND	ND	148	41	ND
Benzo(k)fluoranthene	1800	42	65	29	48	28	ND	23	47	ND	ND
Benzo(a)pyrene	2100	88	131	51	84	48	ND	ND	97	25	ND
Indeno(1,2,3-cd)pyrene	1200	38	77	32	46	26	ND	ND	44	ND	ND
Dibenz(a,h)anthracene	190	ND	20	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	1000	36	66	30	42	23	ND	ND	49	ND	ND

Butyltins	Method = Krone et al., 1988										
	Units Ug/Kg (ppb)										
Tri-n-butyltin	41	2	10	4	2	5	ND	2	5	ND	1
Di-n-butyltin	25	2	16	3	4	4	ND	2	3	ND	ND
n-Butyltin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Organochlorine Pesticides and Polychlorinated Biphenyls											
EPA Method 8081, Pesticides and PCBs											
Units (dry wt.) ug/Kg (ppb)											
Analyte	1-2T	1-2B	3	4	5	6	7	8	9	10	Ref.
alpha-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
beta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
gamma-BHC(Lindane)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aldrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor Epoxide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan II	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin Aldehyde	ND	ND	<3	ND	3	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin Ketone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND	ND	ND	14	ND	ND	ND	ND
Chlordane	<15	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene	<300	ND	<70	<50	<80	<45	ND	ND	<40	ND	ND
Aroclor 1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1254	79	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Aroclor 1260	238	ND	95	70	110	64	ND	30	50	ND	ND

4.2.2 TCLP Chemistry

Summary data for TCLP chemistry are presented in Table 4-4. Chemistry laboratory reports are provided by CAS and are presented in Appendix D.

TCLP data indicate that none of the 13 metals was present in the leachate at levels above the detection limits. I.e., the CLP extraction did not liberate detectable amounts of the metals from the marine sediments.

Table 4-4 TCLP Chemistry Results

TCLP Metals											
Units Mg/L (ppm)											
Analyte	**1-2T**	**1-2B**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Ref.**
Antimony	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Beryllium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

4.3 BIOASSAY RESULTS

Solid Phase test results are presented in section 4.3.1. Suspended Particulate testing results are presented in Section 4.3.2. Bioassay laboratory reports provided by Ogden Environmental detail analytical results, statistical evaluations and other test information such as water quality and QA/QC issues. The bioassay laboratory report is provided in Appendix E.

4.3.1 Solid Phase Tests

Summary data for solid phase tests are presented in Table 4-5.

Organisms were exposed to test sediments for 10 days. Test sediments were sieved after ten days. The live and dead amphipods were recorded after sieving. Test data indicate that all SP test samples passed EPA/ACOE “Green Book” ocean disposal criteria (significantly reduced survival compared to reference coupled with a mean survival reduction > 20% from the reference).

Table 4-5 Solid Phase Bioassay Results

TEST SITE	REPLICATE	NO. ALIVE	NO. DEAD	% SURVIVAL	AVE. % SURVIVAL
Control	A	18	2	90	
	B	20	0	100	
	C	20	0	100	
	D	20	0	100	
	E	20	0	100	98
Reference	A	18	2	90	
	B	17	3	85	
	C	19	1	95	
	D	20	0	100	
	E	20	0	100	94
1-2 Top	A	18	2	90	
	B	18	2	90	
	C	17	3	85	
	D	19	1	95	
	E	20	0	100	92
1-2 Bottom	A	18	2	90	
	B	17	3	85	
	C	18	2	90	
	D	19	1	95	
	E	17	3	85	89
3	A	19	1	95	
	B	18	2	90	
	C	18	2	90	
	D	17	3	85	
	E	18	2	90	90
4	A	16	4	80	
	B	19	1	95	
	C	19	1	95	
	D	18	2	90	
	E	20	0	100	92
5	A	19	1	95	
	B	18	2	90	
	C	19	1	95	
	D	18	2	90	
	E	19	1	95	93
6	A	20	0	100	
	B	19	1	95	
	C	20	0	100	
	D	19	1	95	
	E	19	1	95	97
7	A	15	5	75	
	B	19	1	95	
	C	19	1	95	

TEST SITE	REPLICATE	NO. ALIVE	NO. DEAD	% SURVIVAL	AVE. % SURVIVAL
7	D	20	0	100	
	E	19	1	95	92
8	A	20	0	100	
	B	20	0	100	
	C	19	1	95	
	D	18	2	90	
	E	20	0	100	97
9	A	19	1	95	
	B	18	2	90	
	C	19	1	95	
	D	19	1	95	
	E	20	0	100	95
10	A	19	1	95	
	B	20	0	100	
	C	18	2	90	
	D	20	0	100	
	E	18	2	90	95

4.3.2 Suspended Particulate Phase Tests

Summary data for suspended particulate phase tests are presented in Table 4-6. Complete laboratory reports are provided in Appendix E.

For the survival endpoint, SPP tests indicated that significantly different LC_{50} levels were present at five sites (1-2 Bottom; 3; 4; 6; and 7). The LC_{50} (Lethal Concentration 50) represents the calculated concentration of the sediment elutriate that would result in mortality of 50% compared to the control water. Samples from Sites 1-2 Top; 5; 8; 9; 10 and Reference had LC_{50} results of >100% concentration of elutriate. Of the samples that produced LC_{50} values less than 100%, the values ranged from a low of 67% survival at 1-2 Bottom to 81% survival at Station 6.

For the development endpoint, SPP tests indicated significantly different EC_{50} (Effects Concentration 50) concentrations at five sites (1-2 Bottom; 3; 4; 6; and 7). The EC_{50} represents the calculated concentration of the sediment elutriate that would effect normal development by 50% when compared to the control water. Samples from Sites 1-2 Top; 5; 8; 9; 10 and Reference had EC_{50} results of >100% concentration of elutriate. Of the samples that produced EC_{50} values less than 100%, the EC_{50} values ranged from a low of 62% at Site 4 to a high of 73% at Site 3.

This SPP data indicate that the sediment will likely pass EPA/ACOE ocean disposal criteria for these tests. The EPA/ACOE allow input of the SPP data into various models that allow for dilution to be factored in. Oceanographic data such as depth, temperature, and currents; specific vessel factors such as volume, speed of discharge, and speed of vessel; and sediment factors such as percent moisture, particle size and cohesiveness are combined to predict biological effects on the water column biota. Past experience with running the models indicates that EC_{50} levels of the

magnitude measured in this project do not cause failure of the "Green Book" SPP ocean disposal criteria. The information does indicate that some low level toxicity is present within the project area. This contamination may have ramifications in future bioaccumulation testing and SP testing of different species.

Table 4-6 SPP Bioassay Results

Test Site	Suspended Particulate Phase Analyses (percent elutriate)	
	Bivalve Larvae Survival LC_{50}	Bivalve Larvae Development EC_{50}
Reference	>100	>100
1T+2T	>100	>100
1B+2B	67	65
3	77	73
4	77	62
5	>100	>100
6	81	71
7	70	70
8	>100	>100
9	>100	>100
10	>100	>100

5.0 REFERENCES

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Appendix A

Core Logs

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 3 Oct 97	Project: Navy Homeporting, Pearl Harbor	Recorder: Hardoh
Station ID: 1		Attempt 1 of 3
Latitude: 21° 21.264'	Longitude: 157° 57.382'	Nav Datum: WGS 84

Time: 1353	Depth (ft): 45.5	Tide (ft): 1.0	Dep - Tide = 45.5 - 1 = 44.5	Depth MLLW (ft): 44.5
SAP Dep. 52	SAP-MLLW = 52 - 44.5 = 7.5	Target Core Length: 7.5		Final Core Length (ft):
Start Tape (ft) 35.5	Finish Tape (ft) 43.5	Finish-Start = Penetration (ft) 43.5 - 35.5 = 8		

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan/Grey	None	Silt/clay	1-2T	
2	2	①		①		
3	3			silt/clay/shell/reef	1-2B	
4	4					
5	5					
6	6					
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes: ① Grey sand / sand blast patch - ≈ 6"

Tip plugged w/ rocks/reef/shell material - limited retrieval

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 31 Oct 97	Project: **Navy Homeporting, Pearl Harbor**				Recorder: Hardin	
Station ID: 1				Attempt 2 of 3		
Latitude: 21° 21.269'		Longitude: 157° 57.384'			Nav Datum: **WGS 84**	
Time: 1431	Depth (ft): 45.5	Tide (ft): 1.1	Dep - Tide = 45.5 - 1.1 = 44.4		Depth MLLW (ft): 44.4	
SAP Dep. 52	SAP-MLLW = 52 - 44.4 =		Target Core Length: 7.6		Final Core Length (ft): 3.5	
Start Tape (ft) 35.5		Finish Tape (ft) 43.5		Finish-Start = Penetration (ft) 43.5-35.5 = 8		

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan/Grey	None	Silt/clay	1-2 T	
2	2					
3	3			Silt/clay/Rock, reef	1-2 B	
4	4					3.5
5	5					
6	6					
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes: Station moved to ~~[illegible]~~ ≈130-150' off of pier to try and avoid rock/reef tip plugs

→ Tip still plugged w/ rock/reef material

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 31 Oct 97	Project: Navy Homeporting, Pearl Harbor	Recorder: Hardin
Station ID: 1		Attempt 3 of 3
Latitude: 21° 21.282'	Longitude: 157° 57.381'	Nav Datum: WGS 84

Time: 15:18	Depth (ft): 45.5	Tide (ft): 1.1	Dep - Tide = 45.5 - 1.1 = 44.4	Depth MLLW (ft): 44.4
SAP Dep. 52	SAP-MLLW = 52 - 44.4 = 7.6		Target Core Length: 7.6	Final Core Length (ft): 4
Start Tape (ft) 35.5	Finish Tape (ft) 44.5		Finish-Start = Penetration (ft) 44.5 - 35.5 = 9'	

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan/Grey	None	Silt/Clay	1-2T	
2	2					
3	3			Silt/Clay/Rock/Reef	1-2B	
4	4					
5	5					
6	6					
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes: Station moved to ≈ 75' from pier
Tip plugged by rock/reef material -
Retrieval limited.

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 31 OCT 97	Project: Navy Homeporting, Pearl Harbor	Recorder: Hardin
Station ID: 2		Attempt 1 of 1
Latitude: 21° 21.399'	Longitude: 157° 57.300'	Nav Datum: WGS 84

Time: 1325	Depth (ft): 46.5	Tide (ft): 0.9	Dep - Tide = 46.5 - 0.9 = 45.6	Depth MLLW (ft): 45.6
SAP Dep. 52	SAP-MLLW = 52 - ~~46.5~~ 45.6 = 6.4	Target Core Length: 6.4		Final Core Length (ft): 6.4
Start Tape (ft) 36.5	Finish Tape (ft) ~~43.5~~ 44.5	Finish-Start = Penetration (ft) 44.5 - 36.5 = 8'		

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan/Grey	None	Silt/Clay-Sand	1-2T	
2	2			~~Silt/Clay~~		
3	3					
4	4				1-2B	
5	5					
6	6					
7	7					6.4'
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes:

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 31/Oct/97	Project: Navy Homeporting, Pearl Harbor		Recorder: Hardin
Station ID: 3		Attempt 1 of 1	
Latitude: 21° 21.368'	Longitude: 157° 57.380		Nav Datum: WGS 84

Time: 1122	Depth (ft): 46	Tide (ft): 0.5	Dep - Tide = 46 - 0.5 = 45.5	Depth MLLW (ft): 45.5
SAP Dep. 52	SAP-MLLW = 52 - 45.5 = 6.5		Target Core Length: 6.5	Final Core Length (ft): 6.5
Start Tape (ft) 36	Finish Tape (ft) 545		Finish-Start = Penetration (ft) 45-36 = 9	

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan, Grey	None	silt/clay	3	
2	2					
3	3					
4	4					
5	5					
6	6					
7	7					6.5'
8	8				Discarded	
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes:

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 31 Oct 97	Project: Navy Homeporting, Pearl Harbor	Recorder: Hardin
Station ID: 4		Attempt 1 of 2
Latitude: 21° 21.562'	Longitude: 157° 57.335'	Nav Datum: WGS 84

Time: 0845	Depth (ft): 47.5	Tide (ft): 0.7	Dep - Tide = 47.5-0.7=46.8	Depth MLLW (ft): 46.8
SAP Dep. 52	SAP-MLLW = 52-46.8=5.2		Target Core Length: 5.2'	Final Core Length (ft): 5.2
Start Tape (ft) 37.5	Finish Tape (ft) 46.5		Finish-Start = Penetration (ft) 9' = 46.5-37.5	

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan/Grey (1)	None	Silt/Clay	4	
2	2					
3	3					
4	4	(1)				
5	5	Lighter tan grey				
6	6				Discarded	5.2'
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes: (1) Some dark spots in core, no odor

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 30/OCT/97	Project: Navy Homeporting, Pearl Harbor	Recorder: Hardin
Station ID: 5		Attempt 1 of 2
Latitude: 21° 21.791'	Longitude: 157 57.065'	Nav Datum: WGS 84

Time: 1509	Depth (ft): 47	Tide (ft): 1.3	Dep - Tide = 47-1.3=45.7	Depth MLLW (ft): 45.7
SAP Dep. 52	SAP-MLLW = 52-45.7=6.3		Target Core Length: 6.3	Final Core Length (ft): 2.5
Start Tape (ft) 37	Finish Tape (ft) 44		Finish-Start = Penetration (ft) 44-37=7.0	

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Light brown	None	silt/clay	5	
2	2					
3	3			silt/clay/gravel		
4	4					
5	5					
6	6					
7	7			Sample retrieval limited by		
8	8			hard packed material blocking		
9	9			cutter head.		
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes:

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 31 OCT 97		Project: Navy Homeporting, Pearl Harbor				Recorder: Hardin	
Station ID: 4					Attempt 2 of 2		
Latitude: 21° 21.558'			Longitude: 157° 57.334'			Nav Datum: WGS 84	
Time: 0929	Depth (ft): 47.2	Tide (ft): 0.5	Dep - Tide = 47.2 - 0.5 = 46.7			Depth MLLW (ft): 46.7	
SAP Dep. 52	SAP-MLLW = 52-46.7 = 5.3		Target Core Length: 5.3			Final Core Length (ft): 4.5	
Start Tape (ft) 37.2		Finish Tape (ft) 43.2			Finish-Start = Penetration (ft) 43.2 - 37.2 = 6		

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan	None	silt/clay	4	
2	2	①		Some shell		
3	3					
4	4					
5	5					4.5'
6	6					
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes: Second core taken for Bioassay —
Some compaction of core / limited
① dark spot in core, no odor

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 30/Oct/97	Project: Navy Homeporting, Pearl Harbor	Recorder: Hardin
Station ID: 5		Attempt 2 of 2
Latitude: 21° 21.792'	Longitude: 157° 57.068'	Nav Datum: WGS 84

Time: 1545	Depth (ft): 47	Tide (ft): 1.3	Dep - Tide = 47-1.3=45.7	Depth MLLW (ft): 45.7
SAP Dep. 52	SAP-MLLW = 52-45.7=6.3		Target Core Length: 6.3	Final Core Length (ft): 4.5
Start Tape (ft) 37		Finish Tape (ft) 46		Finish-Start = Penetration (ft) 46-37=9

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Light Brown	None	Silt/Clay	5	
2	2					
3	3					
4	4			silt/clay/gravel		
5	5					4.5
6	6					
7	7					
8	8			Retrieval limited by packed		
9	9			core tip - sediment very compact		
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes: Second Core taken for Bioassays.

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 31 Oct 97	Project: Navy Homeporting, Pearl Harbor	Recorder: Hardin
Station ID: 6		Attempt 1 of 2
Latitude: 21° 21.473'	Longitude: 157° 57.336'	Nav Datum: WGS 84

Time: 1038	Depth (ft): 49'	Tide (ft): 0.4	Dep - Tide = 49-0.4=48.6	Depth MLLW (ft): 48.6
SAP Dep. 52	SAP-MLLW = 52-48.6=3.4		Target Core Length: 3.4	Final Core Length (ft): 3.4
Start Tape (ft) 42	Finish Tape (ft) 48		Finish-Start = Penetration (ft) 48-42=6'	

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan	None	Silt/clay (1)	6	
2	2					
3	3					
4	4				~~Discarded~~ 3.4'	
5	5				~~Bag~~	
6	6					
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes: (1) some shells

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 3/0c/97	Project: Navy Homeporting, Pearl Harbor		Recorder: Hardin
Station ID: 6		Attempt 2 of 2	
Latitude: 21° 21.477'	Longitude: 157° 57.333'		Nav Datum: WGS 84
Time: 1055	Depth (ft): 49.5	Tide (ft): 0.4	Dep - Tide = 49.5-0.4=49.1	Depth MLLW (ft): 49.1
SAP Dep. 52	SAP-MLLW = 52-49.1=2.9	Target Core Length: 2.9	Final Core Length (ft): 2.9
Start Tape (ft) ~~44.5~~ 39.5	Finish Tape (ft) ~~54.5~~ 44.5	Finish-Start = Penetration (ft) 44.5-39.5=5	

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan	None	Silt/Clay	6	
2	2					
3	3					2.9'
4	4				Discarded	
5	5				AH	
6	6					
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes: second core taken for Bioassay

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 30/OCT/97	Project: Navy Homeporting, Pearl Harbor	Recorder: Hardin
Station ID: 7		Attempt 1 of 1
Latitude: 21° 21.555'	Longitude: 157° 57.019'	Nav Datum: WGS 84

Time: 1425	Depth (ft): 46'	Tide (ft): 1.2	Dep - Tide = 46-1.2=44.8	Depth MLLW (ft): 44.8
SAP Dep. 52	SAP-MLLW = 52-44.8=7.2		Target Core Length: 7.2	Final Core Length (ft): 7.2
Start Tape (ft) 36	Finish Tape (ft) 46		Finish-Start = Penetration (ft) 46-36=10	

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	TAN	None	silt/clay/sand	7	
2	2			w/shell		
3	3					
4	4					
5	5					
6	6					
7	7					
8	8					7.2
9	9					Discarded
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes:

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 30 Oct 97 | Project: Navy Homeporting, Pearl Harbor | Recorder: Harding

Station ID: 8 | Attempt 1 of 1

Latitude: 21° 21.163' | Longitude: 157° 57.865' | Nav Datum: WGS 84

Time: 1347 | Depth (ft): 45 | Tide (ft): 1.1 | Dep - Tide = 45-1.1 = 43.9 | Depth MLLW (ft): 43.9

SAP Dep 52 | SAP-MLLW = 52-43.9 = 8.1 | Target Core Length: 8.1' | Final Core Length (ft): 8.1

Start Tape (ft) 35 | Finish Tape (ft) 45.5 | Finish-Start = Penetration (ft) 45.5 - 35 = 9.5

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan/Light Grey	None	Silt/clay	8	
2	2					
3	3			Silt/clay sand/shell		
4	4		Sulfides			
5	5					
6	6					
7	7					
8	8					8.1
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes:

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 30/Oct/97	Project: **Navy Homeporting, Pearl Harbor**	Recorder: Hardin
Station ID: 9		Attempt 1 of 3
Latitude: 21° 20.975'	Longitude: 157° 58.085'	Nav Datum: **WGS 84**

Time: 1049	Depth (ft): 48.0	Tide (ft): 0.5	Dep - Tide = 48-0.5 = 47.5	Depth MLLW (ft): 47.5
SAP Dep. 52	SAP-MLLW = 52-47.5 = 4.5		Target Core Length: 4.5'	Final Core Length (ft): —

Start Tape (ft) 38.0	Finish Tape (ft) 44.0	Finish-Start = Penetration (ft) 44.0 - 38.0 = 6'

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1					
2	2					
3	3					
4	4					
5	5					
6	6		NO SAMPLE			
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes: Core lost - core cutter/catcher rivets sheared-

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 30/OCT/97	Project: **Navy Homeporting, Pearl Harbor**	Recorder: Hardin
Station ID: 9	Attempt 2 of 3	
Latitude: 21° 20.977′	Longitude: 157° 58.083′	Nav Datum: **WGS 84**

Time: 11:13	Depth (ft): 48.0	Tide (ft): 0.6	Dep - Tide = 48-0.6 = 47.4	Depth MLLW (ft): 47.4
SAP Dep 52	SAP-MLLW = 52-47.4 = 4.6	Target Core Length: 4.6		Final Core Length (ft): 4.4
Start Tape (ft) 38	Finish Tape (ft) 44	Finish-Start = Penetration (ft) 44-38 = 6		

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan	None	Silt/Sand	9	
2	2					
3	3			~~Silt/Sand/Rock~~ Silt/Sand/Rock		
4	4					
5	5					4.4′
6	6					
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes:

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 30/Oct/97	Project: **Navy Homeporting, Pearl Harbor**	Recorder: Hardin
Station ID: 9 ~~21° 28.975~~	Attempt 3 of 3	
Latitude: 21° 28.975′	Longitude: 157 58.081′	Nav Datum: **WGS 84**

Time: 1142	Depth (ft): 48.1	Tide (ft): 0.7	Dep - Tide = 48.1-0.7= 47.4	Depth MLLW (ft): 47.4
SAP Dep. 52	SAP-MLLW = 52-47.4= 4.6		Target Core Length: 4.6′	Final Core Length (ft): 4.6

Start Tape (ft) 38.1	Finish Tape (ft) ~~44.1~~ 46.1	Finish-Start = Penetration (ft) 46.1-38.1 = 8′

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan	None	Silt/Sand	9	
2	2					
3	3			Silt/sand/		
4	4			Reef		
5	5					4.6′
6	6				Discarded	
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes: 2nd core taken for Bioassay

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

Date: 30/OCT/97	Project: **Navy Homeporting, Pearl Harbor**	Recorder: Hardin
Station ID: 10		Attempt 1 of 2
Latitude: 21° 19.922'	Longitude: 157° 58.168'	Nav Datum: **WGS 84**

Time: 0854	Depth (ft): 48.5	Tide (ft): 0.5	Dep - Tide = 48.5 - 0.5 = 48	Depth MLLW (ft): 48.0
SAP Dep. 52	SAP-MLLW = 52-48=4		Target Core Length: 4'	Final Core Length (ft): 4'
Start Tape (ft) 38.5	Finish Tape (ft) 44.5		Finish-Start = Penetration (ft) 6'	

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan	None	Silt/sand/rock	10	
2	2					
3	3					
4	4			Rock-Sand-Silt Reef		40'
5	5					
6	6					
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

Notes:

MEC ANALYTICAL SYSTEMS INCORPORATED
VIBRACORE CORING LOG

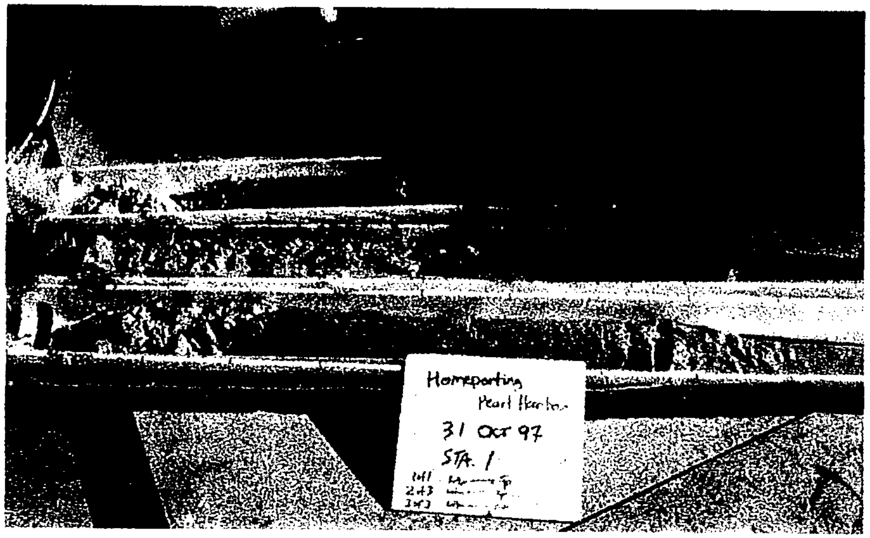
Date: 30/Oct/97	Project: **Navy Homeporting, Pearl Harbor**		Recorder: Hardin	
Station ID: 10			Attempt 2 of 2	
Latitude: 21° 19.924'	Longitude: 157° 58.168'		Nav Datum: **WGS 84**	
Time: 10:01	Depth (ft): 47.5	Tide (ft): 0.4	Dep - Tide = 47.5 - 0.4 = 47.1	Depth MLLW (ft): 47.1
SAP Dep. 52	SAP-MLLW = 52-47.1 = 4.9		Target Core Length: 4.9'	Final Core Length (ft): 4.5'
Start Tape (ft) 37.5	Finish Tape (ft) 43.5		Finish-Start = Penetration (ft) 43.5-37.5 = 6'	

Pen. Depth (ft)	Retriev Depth (ft)	Color	Odor	Sediment Type	Sample ID by Depth	Misc.
1	1	Tan	None	Silt/Sand/Rock	10	
2	2					
3	3			Sand/Rock-Reef		
4	4					
5	5					4.5'
6	6					
7	7					
8	8					
9	9					
10	10					
11	11					
12	12					
13	13					
14	14					
15	15					

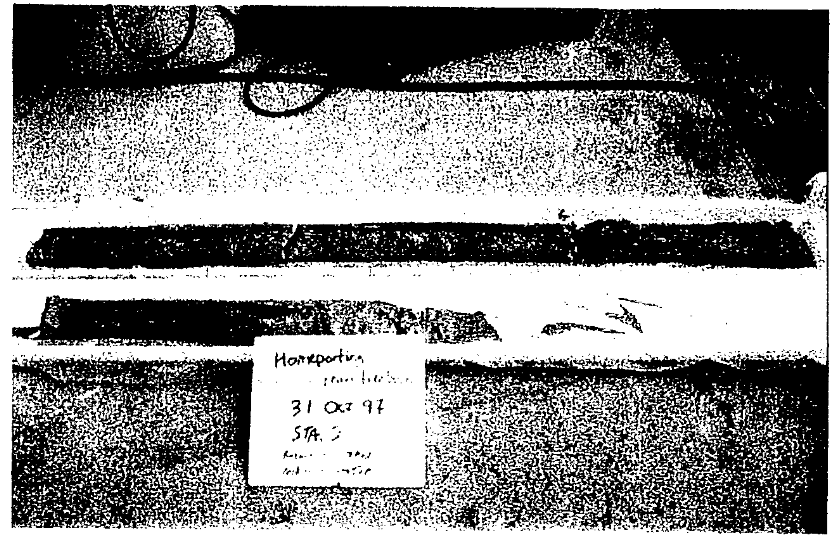
Notes: Second core taken for Bioassay

Appendix B

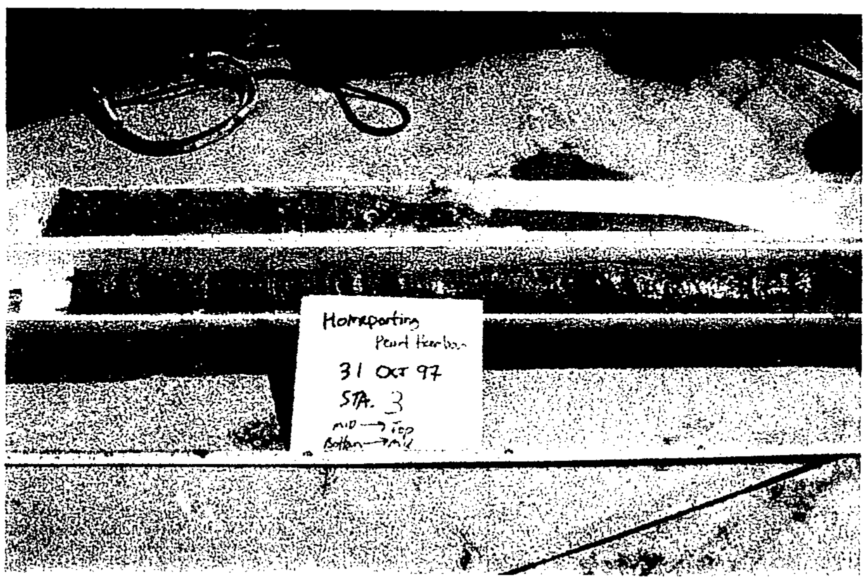
Core Photographs



Station 1

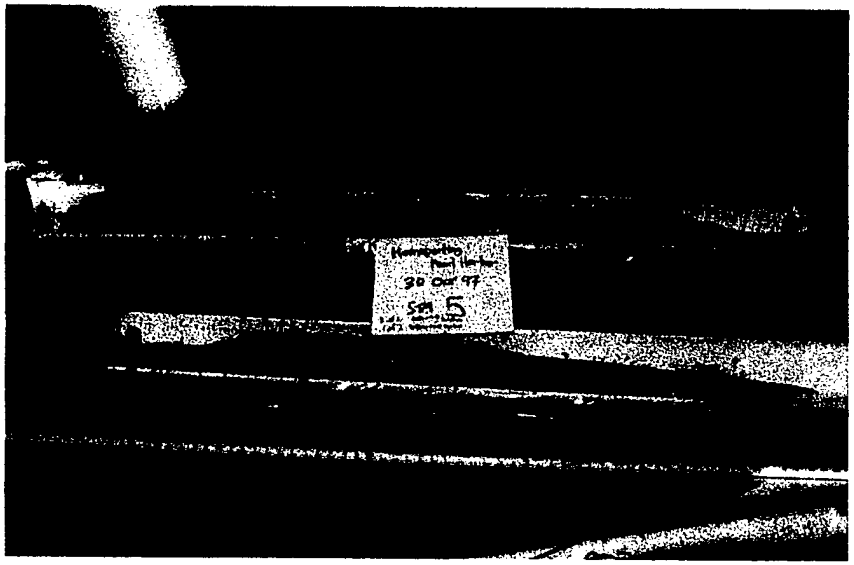


Station 2

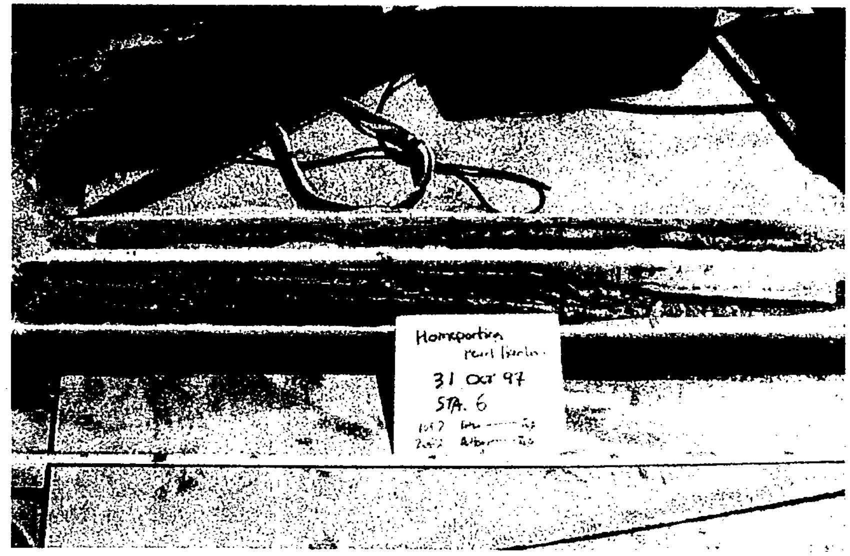


Station 3

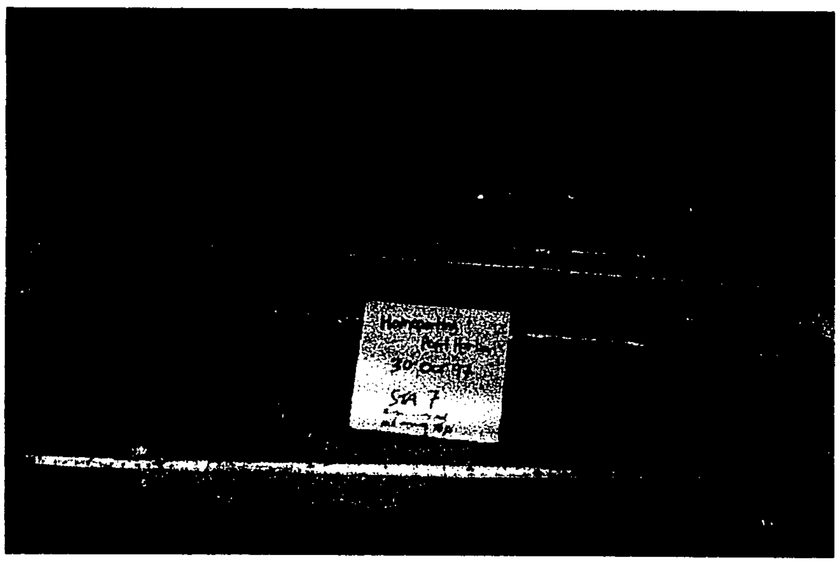

Station 4



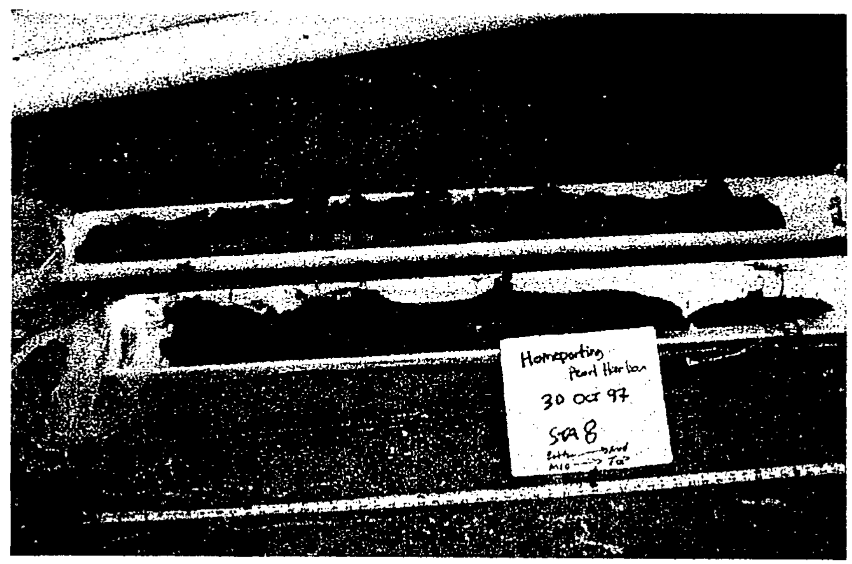
Station 5



Station 6

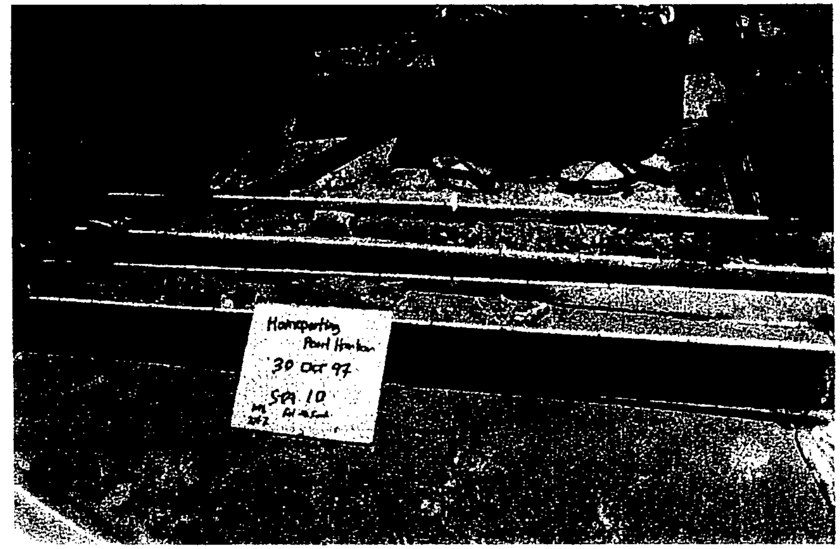


Station 7



Station 8

Station 9



Station 10

Appendix C

Physical Chemistry

MFC ANALYTICAL SYSTEMS, INC.

November 17, 1997 Batch No.: 971114A

Dear John:

Enclosed are the results of samples submitted to our laboratory on 07Nov97 for analysis of TOC (Method ASTM D2579, modified). For your reference, these samples have been assigned our batch number 971114A.

All analyses were performed consistent with our laboratory's quality assurance program and all samples met the quality control criteria specified in the above methods and/or our internal SOPs.

Please call if you have any questions.

Sincerely,

Brian Riley
Laboratory Manager

2433 Impala Dr., Carlsbad, CA 92008
(619) 931-8081 FAX (619) 931-1580

6060 Corte del Cedro, Carlsbad, CA 92009
(619) 931-9225 FAX (619) 931-9251

98 Main St., Suite 428, Tiburon, CA 94920
(415) 435-1847 FAX (415) 435-0479

Analytical Report

Project: Pearl Harbor Homeporting
Contact: John Hardin
Sample Matrix: Soil

Date Received: 07Nov97
Date Analyzed: 14Nov97
Batch No.: 971114A

Total Organic Carbon
Analysis Method: ASTM D2579, modified
Percent (%)

Sample I.D.	MRL	Result
1-2-B	0.002	0.875
1-2-T	0.002	1.050
SITE 3	0.002	0.909
SITE 4	0.002	0.980
SITE 5	0.002	0.650
SITE 6	0.002	0.924
SITE 7	0.002	0.933
SITE 8	0.002	0.403
SITE 9	0.002	0.693
SITE 10	0.002	2.831
GRANDID CONTROL	0.002	0.046
REFERENCE	0.002	0.127

Method blank ND

Approved by: [signature]

Date: 17Nov97

QA/QC Report

Project: Pearl Harbor Homeporting
Contact: John Hardin
Sample Matrix: Soil

Date Received: 07Nov97
Date Analyzed: 14Nov97
Batch No.: 971114A

Duplicate Summary
Total Organic Carbon
Percent (%)

Sample I.D.	Sample Result	Duplicate Result	Average	RPD
REFERENCE	0.127	0.122	0.124	3.739
SITE 9	0.693	0.690	0.691	0.477

ASTM D2579, modified

Approved by: [signature]

Date: 17Nov97

GRAIN SIZE ANALYSIS

Contract:	Pearl Harbor Homeporting
Contact person:	John Hardin
Date of analysis:	10Nov97
Date of report:	14Nov97
Analysis method:	Sieve/pipette (Plumb, 1981)
Sample Identification:	1-2-T
Total sample weight:	18.345 grams

-------- Size ------		Weight		Cumulative
Microns	Phi	grams	Percent	Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.018	0.098	0.098
1000.000	0.0	0.103	0.561	0.660
707.107	0.5	0.194	1.058	1.717
500.000	1.0	0.314	1.712	3.429
353.553	1.5	0.541	2.949	6.378
250.000	2.0	0.171	0.932	7.310
176.777	2.5	0.191	1.041	8.351
125.000	3.0	0.186	1.014	9.365
88.388	3.5	0.180	0.981	10.346
62.500	4.0	0.117	0.638	10.984
31.250	5.0	0.787	4.288	15.272
15.625	6.0	1.863	10.156	25.428
7.812	7.0	2.650	14.444	39.873
3.906	8.0	2.277	12.413	52.286
1.953	9.0	1.449	7.899	60.185
< 1.953	> 9.0	7.304	39.815	100.000

% < 4 phi = 89.016
% > 1 phi = 1.717
% gravel = 0.000
% sand = 10.984
% silt = 41.302
% clay = 47.714

Sample Statistics

Median		Mean		Dispersion	Skewness
phi	microns	phi	microns		
7.816	4.44	8.420	2.92	3.349	0.180

5th percentile = 1.266
16th percentile = 5.072
50th percentile = 7.816
84th percentile = 11.769
95th percentile = .
*** 84th percentile extrapolated ***
*** 95th percentile not reached ***

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

GRAIN SIZE ANALYSIS

Contract:	Pearl Harbor Homeporting
Contact person:	John Hardin
Date of analysis:	10Nov97
Date of report:	14Nov97
Analysis method:	Sieve/pipette (Plumb, 1981)
Sample Identification:	1-2-B
Total sample weight:	19.429 grams

-------- Size ------ Microns	Phi	Weight grams	Percent	Cumulative Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.014	0.072	0.072
1000.000	0.0	0.128	0.659	0.731
707.107	0.5	0.135	0.695	1.426
500.000	1.0	0.152	0.782	2.208
353.553	1.5	0.148	0.762	2.970
250.000	2.0	0.228	1.174	4.143
176.777	2.5	0.230	1.184	5.327
125.000	3.0	0.353	1.817	7.144
88.388	3.5	0.268	1.379	8.523
62.500	4.0	0.284	1.462	9.985
31.250	5.0	0.787	4.049	14.034
15.625	6.0	1.946	10.016	24.050
7.812	7.0	2.608	13.425	37.475
3.906	8.0	2.443	12.573	50.048
1.953	9.0	1.822	9.376	59.424
< 1.953	> 9.0	7.884	40.576	100.000

% < 4 phi = 90.015
% > 1 phi = 1.426
% gravel = 0.000
% sand = 9.985
% silt = 40.063
% clay = 49.952

Sample Statistics

Median phi	Median microns	Mean phi	Mean microns	Dispersion	Skewness
7.996	3.92	8.407	2.95	3.211	0.128

5th percentile = 2.362
16th percentile = 5.196
50th percentile = 7.996
84th percentile = 11.618
95th percentile = .
*** 84th percentile extrapolated ***
*** 95th percentile not reached ***

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

GRAIN SIZE ANALYSIS

Contract:	Pearl Harbor Homeporting
Contact person:	John Hardin
Date of analysis:	10Nov97
Date of report:	14Nov97
Analysis method:	Sieve/pipette (Plumb, 1981)
Sample Identification:	SITE 3
Total sample weight:	17.376 grams

-------- Size ------		Weight		Cumulative
Microns	Phi	grams	Percent	Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.000	0.000	0.000
1000.000	0.0	0.004	0.023	0.023
707.107	0.5	0.004	0.023	0.046
500.000	1.0	0.022	0.127	0.173
353.553	1.5	0.195	1.122	1.295
250.000	2.0	0.045	0.259	1.554
176.777	2.5	0.037	0.213	1.767
125.000	3.0	0.038	0.219	1.985
88.388	3.5	0.052	0.299	2.285
62.500	4.0	0.070	0.403	2.688
31.250	5.0	0.787	4.527	7.215
15.625	6.0	1.987	11.437	18.652
7.812	7.0	2.691	15.488	34.139
3.906	8.0	2.608	15.011	49.150
1.953	9.0	1.656	9.531	58.681
< 1.953	> 9.0	7.180	41.319	100.000

% < 4 phi = 97.312
% > 1 phi = 0.046
% gravel = 0.000
% sand = 2.688
% silt = 46.463
% clay = 50.850

Sample Statistics

Median		Mean		Dispersion	Skewness
phi	microns	phi	microns		
8.089	3.67	8.712	2.38	2.944	0.212

5th percentile = 4.511
16th percentile = 5.768
50th percentile = 8.089
84th percentile = 11.656
95th percentile = .
*** 84th percentile extrapolated ***
*** 95th percentile not reached ***

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

GRAIN SIZE ANALYSIS

Contract: Pearl Harbor Homeporting
Contact person: John Hardin
Date of analysis: 10Nov97
Date of report: 14Nov97
Analysis method: Sieve/pipette (Plumb, 1981)
Sample Identification: SITE 4
Total sample weight: 19.469 grams

Size Microns	Size Phi	Weight grams	Percent	Cumulative Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.001	0.005	0.005
1000.000	0.0	0.038	0.195	0.200
707.107	0.5	0.033	0.169	0.370
500.000	1.0	0.045	0.231	0.601
353.553	1.5	0.053	0.272	0.873
250.000	2.0	0.086	0.442	1.315
176.777	2.5	0.105	0.539	1.854
125.000	3.0	0.168	0.863	2.717
88.388	3.5	0.132	0.678	3.395
62.500	4.0	0.160	0.822	4.217
31.250	5.0	0.911	4.678	8.895
15.625	6.0	1.987	10.208	19.103
7.812	7.0	2.526	12.972	32.075
3.906	8.0	1.366	7.018	39.093
1.953	9.0	2.898	14.886	53.979
< 1.953	> 9.0	8.960	46.021	100.000

% < 4 phi = 95.783
% > 1 phi = 0.370
% gravel = 0.000
% sand = 4.217
% silt = 34.876
% clay = 60.907

Sample Statistics

Median phi	Median microns	Mean phi	Mean microns	Dispersion	Skewness
8.733	2.35	8.356	3.05	2.660	-0.141

5th percentile = 4.167
16th percentile = 5.696
50th percentile = 8.733
84th percentile = 11.017
95th percentile = .
*** 84th percentile extrapolated ***
*** 95th percentile not reached ***

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

GRAIN SIZE ANALYSIS

Contract:	Pearl Harbor Homeporting
Contact person:	John Hardin
Date of analysis:	10Nov97
Date of report:	14Nov97
Analysis method:	Sieve/pipette (Plumb, 1981)
Sample Identification:	SITE 5
Total sample weight:	20.666 grams

-------- Size ------		Weight		Cumulative
Microns	Phi	grams	Percent	Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.113	0.547	0.547
1000.000	0.0	0.285	1.379	1.926
707.107	0.5	0.368	1.781	3.707
500.000	1.0	0.399	1.931	5.637
353.553	1.5	0.743	3.595	9.233
250.000	2.0	0.373	1.805	11.037
176.777	2.5	0.626	3.029	14.067
125.000	3.0	0.679	3.286	17.352
88.388	3.5	0.587	2.840	20.193
62.500	4.0	0.453	2.192	22.385
31.250	5.0	1.408	6.812	29.196
15.625	6.0	2.236	10.819	40.015
7.812	7.0	2.360	11.420	51.435
3.906	8.0	1.987	9.617	61.051
1.953	9.0	1.449	7.012	68.063
< 1.953	> 9.0	6.600	31.937	100.000

% < 4 phi = 77.615
% > 1 phi = 3.707
% gravel = 0.000
% sand = 22.385
% silt = 38.666
% clay = 38.949

Sample Statistics

Median		Mean		Dispersion	Skewness
phi	microns	phi	microns		
6.874	8.52	6.835	8.76	4.041	-0.010

5th percentile = 0.835
16th percentile = 2.794
50th percentile = 6.874
84th percentile = 10.875
95th percentile = .
*** 84th percentile extrapolated ***
*** 95th percentile not reached ***

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

GRAIN SIZE ANALYSIS

Contract: Pearl Harbor Homeporting
Contact person: John Hardin
Date of analysis: 10Nov97
Date of report: 14Nov97
Analysis method: Sieve/pipette (Plumb, 1981)
Sample Identification: SITE 6
Total sample weight: 17.727 grams

Size Microns	Size Phi	Weight grams	Percent	Cumulative Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.007	0.039	0.039
1000.000	0.0	0.016	0.090	0.130
707.107	0.5	0.040	0.226	0.355
500.000	1.0	0.053	0.299	0.654
353.553	1.5	0.074	0.417	1.072
250.000	2.0	0.138	0.778	1.850
176.777	2.5	0.123	0.694	2.544
125.000	3.0	0.199	1.123	3.667
88.388	3.5	0.156	0.880	4.547
62.500	4.0	0.136	0.767	5.314
31.250	5.0	0.538	3.036	8.350
15.625	6.0	1.573	8.875	17.225
7.812	7.0	2.236	12.612	29.837
3.906	8.0	2.608	14.714	44.551
1.953	9.0	1.780	10.043	54.594
< 1.953	> 9.0	8.049	45.406	100.000

% < 4 phi = 94.686
% > 1 phi = 0.355
% gravel = 0.000
% sand = 5.314
% silt = 39.237
% clay = 55.449

Sample Statistics

Median phi	Median microns	Mean phi	Mean microns	Dispersion	Skewness
8.543	2.68	8.895	2.10	3.033	0.116

5th percentile = 3.795
16th percentile = 5.862
50th percentile = 8.543
84th percentile = 11.928
95th percentile = .
*** 84th percentile extrapolated ***
*** 95th percentile not reached ***

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

GRAIN SIZE ANALYSIS

Contract:	Pearl Harbor Homeporting
Contact person:	John Hardin
Date of analysis:	10Nov97
Date of report:	14Nov97
Analysis method:	Sieve/pipette (Plumb, 1981)
Sample Identification:	SITE 7
Total sample weight:	21.269 grams

-------- Size ------		Weight		Cumulative
Microns	Phi	grams	Percent	Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.077	0.362	0.362
1000.000	0.0	0.173	0.813	1.175
707.107	0.5	0.191	0.898	2.073
500.000	1.0	0.162	0.762	2.835
353.553	1.5	0.421	1.979	4.814
250.000	2.0	0.353	1.660	6.474
176.777	2.5	0.718	3.376	9.850
125.000	3.0	0.920	4.325	14.175
88.388	3.5	0.961	4.518	18.693
62.500	4.0	0.611	2.873	21.566
31.250	5.0	1.756	8.257	29.823
15.625	6.0	1.628	7.653	37.476
7.812	7.0	1.456	6.847	44.323
3.906	8.0	1.713	8.055	52.378
1.953	9.0	2.913	13.694	66.073
< 1.953	> 9.0	7.216	33.927	100.000

% < 4 phi = 78.434
% > 1 phi = 2.073
% gravel = 0.000
% sand = 21.566
% silt = 30.812
% clay = 47.622

Sample Statistics

Median		Mean		Dispersion	Skewness
phi	microns	phi	microns		
7.705	4.79	6.823	8.83	3.621	-0.243

5th percentile = 1.556
16th percentile = 3.202
50th percentile = 7.705
84th percentile = 10.445
95th percentile = .
*** 84th percentile extrapolated ***
*** 95th percentile not reached ***

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

GRAIN SIZE ANALYSIS

Contract: Pearl Harbor Homeporting
Contact person: John Hardin
Date of analysis: 10Nov97
Date of report: 14Nov97
Analysis method: Sieve/pipette (Plumb, 1981)
Sample Identification: SITE 8
Total sample weight: 24.904 grams

-------- Size ------ Microns	Phi	Weight grams	Percent	Cumulative Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.089	0.357	0.357
1000.000	0.0	0.566	2.273	2.630
707.107	0.5	0.520	2.088	4.718
500.000	1.0	0.538	2.160	6.879
353.553	1.5	0.631	2.534	9.412
250.000	2.0	1.367	5.489	14.901
176.777	2.5	1.832	7.356	22.258
125.000	3.0	2.532	10.167	32.425
88.388	3.5	1.549	6.220	38.645
62.500	4.0	0.953	3.827	42.472
31.250	5.0	2.056	8.256	50.728
15.625	6.0	2.699	10.836	61.564
7.812	7.0	2.142	8.600	70.164
3.906	8.0	1.371	5.504	75.668
1.953	9.0	0.900	3.612	79.280
< 1.953	> 9.0	5.160	20.720	100.000

% < 4 phi = 57.528
% > 1 phi = 4.718
% gravel = 0.000
% sand = 42.472
% silt = 33.196
% clay = 24.332

Sample Statistics

Median phi	Median microns	Mean phi	Mean microns	Dispersion	Skewness
4.912	33.22	5.867	17.14	3.792	0.252

5th percentile = 0.565
16th percentile = 2.075
50th percentile = 4.912
84th percentile = 9.659
95th percentile = .
*** 84th percentile extrapolated ***
*** 95th percentile not reached ***

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

GRAIN SIZE ANALYSIS

Contract: Pearl Harbor Homeporting
Contact person: John Hardin
Date of analysis: 10Nov97
Date of report: 14Nov97
Analysis method: Sieve/pipette (Plumb, 1981)
Sample Identification: SITE 9
Total sample weight: 20.542 grams

-------- Size ------ Microns	Phi	Weight grams	Percent	Cumulative Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.000	0.000	0.000
1000.000	0.0	0.263	1.280	1.280
707.107	0.5	0.262	1.275	2.556
500.000	1.0	0.271	1.319	3.875
353.553	1.5	0.271	1.319	5.194
250.000	2.0	0.404	1.967	7.161
176.777	2.5	0.446	2.171	9.332
125.000	3.0	0.848	4.128	13.460
88.388	3.5	0.889	4.328	17.788
62.500	4.0	1.148	5.589	23.376
31.250	5.0	1.628	7.924	31.300
15.625	6.0	2.784	13.554	44.854
7.812	7.0	2.741	13.345	58.199
3.906	8.0	2.056	10.009	68.208
1.953	9.0	1.414	6.881	75.089
< 1.953	> 9.0	5.117	24.911	100.000

% < 4 phi = 76.624
% > 1 phi = 2.556
% gravel = 0.000
% sand = 23.376
% silt = 44.831
% clay = 31.792

Sample Statistics

Median phi	Median microns	Mean phi	Mean microns	Dispersion	Skewness
6.386	11.96	6.611	10.23	3.318	0.068

5th percentile = 1.426
16th percentile = 3.293
50th percentile = 6.386
84th percentile = 9.929
95th percentile = .
*** 84th percentile extrapolated ***
*** 95th percentile not reached ***

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

GRAIN SIZE ANALYSIS

Contract:	Pearl Harbor Homeporting
Contact person:	John Hardin
Date of analysis:	10Nov97
Date of report:	14Nov97
Analysis method:	Sieve/pipette (Plumb, 1981)
Sample Identification:	SITE 10
Total sample weight:	27.566 grams

-------- Size ------		Weight		Cumulative
Microns	Phi	grams	Percent	Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.143	0.519	0.519
1000.000	0.0	0.433	1.571	2.090
707.107	0.5	0.733	2.659	4.749
500.000	1.0	0.864	3.134	7.883
353.553	1.5	1.579	5.728	13.611
250.000	2.0	0.871	3.160	16.771
176.777	2.5	2.137	7.752	24.523
125.000	3.0	1.865	6.766	31.288
88.388	3.5	2.075	7.527	38.816
62.500	4.0	1.640	5.949	44.765
31.250	5.0	2.613	9.479	54.244
15.625	6.0	2.613	9.479	63.722
7.812	7.0	1.671	6.060	69.782
3.906	8.0	1.885	6.837	76.619
1.953	9.0	1.542	5.594	82.213
< 1.953	> 9.0	4.903	17.787	100.000

% < 4 phi = 55.235
% > 1 phi = 4.749
% gravel = 0.000
% sand = 44.765
% silt = 31.854
% clay = 23.381

Sample Statistics

Median		Mean		Dispersion	Skewness
phi	microns	phi	microns		
4.552	42.62	5.562	21.16	3.684	0.274

5th percentile = 0.540
16th percentile = 1.878
50th percentile = 4.552
84th percentile = 9.247
95th percentile = .
*** 84th percentile extrapolated ***
*** 95th percentile not reached ***

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

GRAIN SIZE ANALYSIS

Contract:	Pearl Harbor Homeporting
Contact person:	John Hardin
Date of analysis:	10Nov97
Date of report:	14Nov97
Analysis method:	Sieve/pipette (Plumb, 1981)
Sample Identification:	GRANDID CONTROL
Total sample weight:	30.462 grams

-------- Size ------		Weight		Cumulative
Microns	Phi	grams	Percent	Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.000	0.000	0.000
1000.000	0.0	0.000	0.000	0.000
707.107	0.5	0.005	0.016	0.016
500.000	1.0	0.028	0.092	0.108
353.553	1.5	4.666	15.318	15.426
250.000	2.0	4.723	15.505	30.931
176.777	2.5	7.358	24.155	55.086
125.000	3.0	6.750	22.159	77.244
88.388	3.5	5.165	16.956	94.200
62.500	4.0	0.890	2.922	97.122
31.250	5.0	0.086	0.281	97.403
15.625	6.0	0.086	0.281	97.684
7.812	7.0	0.043	0.141	97.825
3.906	8.0	0.043	0.141	97.966
1.953	9.0	0.043	0.141	98.106
< 1.953	> 9.0	0.577	1.894	100.000

% < 4 phi = 2.878
% > 1 phi = 0.016
% gravel = 0.000
% sand = 97.122
% silt = 0.844
% clay = 2.034

Sample Statistics

Median		Mean		Dispersion	Skewness
phi	microns	phi	microns		
2.395	190.16	2.359	194.94	0.840	-0.043

5th percentile = 1.160
16th percentile = 1.519
50th percentile = 2.395
84th percentile = 3.199
95th percentile = 3.637

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

GRAIN SIZE ANALYSIS

Contract:	Pearl Harbor Homeporting
Contact person:	John Hardin
Date of analysis:	10Nov97
Date of report:	14Nov97
Analysis method:	Sieve/pipette (Plumb, 1981)
Sample Identification:	REFERENCE
Total sample weight:	27.882 grams

-------- Size ------		Weight		Cumulative
Microns	Phi	grams	Percent	Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.000	0.000	0.000
1000.000	0.0	0.000	0.000	0.000
707.107	0.5	0.000	0.000	0.000
500.000	1.0	0.002	0.007	0.007
353.553	1.5	1.496	5.365	5.373
250.000	2.0	1.663	5.964	11.337
176.777	2.5	5.867	21.042	32.379
125.000	3.0	10.094	36.203	68.582
88.388	3.5	7.317	26.243	94.825
62.500	4.0	0.609	2.184	97.009
31.250	5.0	0.086	0.307	97.316
15.625	6.0	0.129	0.461	97.777
7.812	7.0	0.043	0.154	97.931
3.906	8.0	0.043	0.154	98.085
1.953	9.0	0.043	0.154	98.238
< 1.953	> 9.0	0.491	1.762	100.000

% < 4 phi = 2.991
% > 1 phi = 0.000
% gravel = 0.000
% sand = 97.009
% silt = 1.075
% clay = 1.915

Sample Statistics

Median		Mean		Dispersion	Skewness
phi	microns	phi	microns		
2.743	149.34	2.702	153.65	0.591	-0.069

5th percentile = 1.465
16th percentile = 2.111
50th percentile = 2.743
84th percentile = 3.294
95th percentile = 3.540

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

GRAIN SIZE ANALYSIS

Contract: Pearl Harbor Homeporting
Contact person: John Hardin
Date of analysis: 10Nov97
Date of report: 14Nov97
Analysis method: Sieve/pipette (Plumb, 1981)
Sample Identification: SITE 8 A
Total sample weight: 24.904 grams

-------- Size ------		Weight		Cumulative
Microns	Phi	grams	Percent	Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.089	0.357	0.357
1000.000	0.0	0.566	2.273	2.630
707.107	0.5	0.520	2.088	4.718
500.000	1.0	0.538	2.160	6.879
353.553	1.5	0.631	2.534	9.412
250.000	2.0	1.367	5.489	14.901
176.777	2.5	1.832	7.356	22.258
125.000	3.0	2.532	10.167	32.425
88.388	3.5	1.549	6.220	38.645
62.500	4.0	0.953	3.827	42.472
31.250	5.0	2.056	8.256	50.728
15.625	6.0	2.699	10.836	61.564
7.812	7.0	2.142	8.600	70.164
3.906	8.0	1.371	5.504	75.668
1.953	9.0	0.900	3.612	79.280
< 1.953	> 9.0	5.160	20.720	100.000

% < 4 phi = 57.528
% > 1 phi = 4.718
% gravel = 0.000
% sand = 42.472
% silt = 33.196
% clay = 24.332

Sample Statistics

Median		Mean		Dispersion	Skewness
phi	microns	phi	microns		
4.912	33.22	5.867	17.14	3.792	0.252

5th percentile = 0.565
16th percentile = 2.075
50th percentile = 4.912
84th percentile = 9.659
95th percentile = .
*** 84th percentile extrapolated ***
*** 95th percentile not reached ***

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

GRAIN SIZE ANALYSIS

Contract: Pearl Harbor Homeporting
Contact person: John Hardin
Date of analysis: 10Nov97
Date of report: 14Nov97
Analysis method: Sieve/pipette (Plumb, 1981)
Sample Identification: SITE 8 B
Total sample weight: 25.056 grams

-------- Size ------ Microns	Phi	Weight grams	Percent	Cumulative Percent
2000.000	-1.0	0.000	0.000	0.000
1414.214	-0.5	0.000	0.000	0.000
1000.000	0.0	0.743	2.965	2.965
707.107	0.5	0.555	2.215	5.180
500.000	1.0	0.529	2.111	7.292
353.553	1.5	0.640	2.554	9.846
250.000	2.0	1.357	5.416	15.262
176.777	2.5	1.975	7.882	23.144
125.000	3.0	2.503	9.990	33.134
88.388	3.5	1.526	6.090	39.224
62.500	4.0	0.987	3.939	43.163
31.250	5.0	2.313	9.231	52.395
15.625	6.0	2.570	10.257	62.652
7.812	7.0	1.842	7.351	70.003
3.906	8.0	1.585	6.325	76.328
1.953	9.0	1.071	4.274	80.602
< 1.953	> 9.0	4.860	19.398	100.000

% < 4 phi = 56.837
% > 1 phi = 5.180
% gravel = 0.000
% sand = 43.163
% silt = 33.165
% clay = 23.672

Sample Statistics

Median phi	Median microns	Mean phi	Mean microns	Dispersion	Skewness
4.741	37.41	5.760	18.45	3.713	0.275

5th percentile = 0.459
16th percentile = 2.047
50th percentile = 4.741
84th percentile = 9.473
95th percentile = .
*** 84th percentile extrapolated ***
*** 95th percentile not reached ***

MEC Analytical Systems, Inc.
2433 Impala Dr.
Carlsbad, CA 92008

Appendix D

Analytical Chemistry

November 14, 1997

Service Request No: K9708126

John Hardin
Columbia Analytical Services, Inc.
6060 Corte del Cedro, Palomar Airport Bus Park
Carlsbad, CA 92009

Re: Homeport-Pearl Harbor

Dear John:

Enclosed are the results of the sample(s) submitted to our laboratory on November 3, 1997. For your reference, these analyses have been assigned our service request number K9708126.

All analyses were performed according to our laboratory's quality assurance program. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the samples analyzed.

Please call if you have any questions. My extension is 258.

Respectfully submitted,

Columbia Analytical Services, Inc.

Lynda A. Huckestein
Project Chemist

LAH/bf

COLUMBIA ANALYTICAL SERVICES, INC.

Client:	MEC Analytical Systems, Inc.	**Service Request No.:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Received:**	11/3/97
Sample Matrix:	Sediment		

CASE NARRATIVE

All analyses were performed consistent with the quality assurance program of Columbia Analytical Services, Inc. (CAS). This report contains analytical results for sample(s) designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Laboratory Duplicate (DUP), Matrix Spike (MS), Matrix/Duplicate Matrix Spike (MS/DMS), and Laboratory Control Sample (LCS).

All EPA recommended holding times have been met for analyses in this sample delivery group.

The following difficulties were experienced during analysis of this batch:

The Relative Percent Difference (RPD) for the replicate analysis of Zinc in sample Sta-10 was outside the normal CAS control limits. The variability in the results is attributed to the heterogeneous character of the sample. Mixing techniques within the scope of the EPA methodology were used, but were not sufficient for complete homogenization of this sample.

The Matrix Spike (MS) recovery of Antimony for sample Sta-10 was outside the normal CAS control limits because of suspected matrix interference. The Matrix Spike (MS) recoveries of Mercury and Zinc for samples Sta-1-2-B and Sta-10 were not calculated. The analyte concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery. No further corrective action was taken.

As requested, all sediment samples were analyzed for butyltin compounds. Results for the mono-butyl, di-butyl, tributyl tin compounds are reported in the results section of this report. Mono-butyl tin was not detected in any of the sediment samples, however, the results for this compound should be considered as estimated. Recovery of mono-butyl tin is extremely poor by this method in comparison to other butyl tin compounds. All QA/QC associated with the other compounds in the analysis met CAS acceptance criteria.

For the Butyltins analysis, monobutyltin was detected in the method blank above the method reporting limit. All samples that had detectable levels of this compound were reextracted and confirmed the absence of monobutyltin. Since no monobutyltin was detected in the sample and the error associated with levels detected in the method blanks equates to a high bias, the elevated recoveries likely have no significance to the sample results. No further corrective action was taken.

The Tri-n-propyltin surrogate recovery for Butyltins in sample Sta-9 was outside normal CAS control limits because of suspected matrix interference. Since the recovery of Tri-n-pentyltin was acceptable, no further corrective action was taken.

One or two of the surrogate recoveries for Semivolatiles in samples Sta-1-2-T, Sta-3,4,5,6,7 and 10 were outside normal CAS control limits because of suspected matrix interference. The chromatogram showed components that prevented accurate quantitation of the surrogate. No further corrective action was taken.

Approved by ______ WH Date 11/14/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97

Total Solids

Prep Method: NONE
Analysis Method: 160.3M
Test Notes:

Units: PERCENT
Basis: NA

Sample Name	Lab Code	Date Analyzed	Result	Result Notes
Sta-1-2-B	K9708126-001	11/4/97	58.6	
Sta-1-2-T	K9708126-002	11/4/97	47.0	
Sta-3	K9708126-003	11/4/97	43.2	
Sta-4	K9708126-004	11/4/97	49.0	
Sta-5	K9708126-005	11/4/97	52.8	
Sta-6	K9708126-006	11/4/97	46.2	
Sta-7	K9708126-007	11/4/97	54.2	
Sta-8	K9708126-008	11/4/97	63.4	
Sta-9	K9708126-009	11/4/97	50.7	
Sta-10	K9708126-010	11/4/97	69.1	
Reference	K9708126-011	11/4/97	75.6	

Approved By: JC Date: 11/6/97

TSSample/021397a

08126TS.AG1 - 011 11/5/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date Extracted:	NA
		Date Analyzed:	11/5/97

Sulfide, Dissolved
EPA Method 376.2 Modified
Units: mg/Kg (ppm)
Dry Weight Basis

Sample Name	Lab Code	MRL	Result
Sta-1-2-B	K9708126-001	3.0	ND
Sta-1-2-T	K9708126-002	3.0	ND
Sta-3	K9708126-003	3.0	ND
Sta-4	K9708126-004	3.0	ND
Sta-5	K9708126-005	3.0	ND
Sta-6	K9708126-006	3.0	ND
Sta-7	K9708126-007	3.0	ND
Sta-8	K9708126-008	3.0	ND
Sta-9	K9708126-009	3.0	ND
Sta-10	K9708126-010	3.0	ND
Reference	K9708126-011	3.0	ND
Method Blank	K9708126-MB	3.0	ND

Approved By: [signature] Date: 11/10/97

1AMRL/102594
08126WET.MR1 - 1AMRL 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: 11/5/97

Total Metals
Units: mg/Kg (ppm)
Dry Weight Basis

		Sample Name:	**Sta-1-2-B**	**Sta-1-2-T**	**Sta-3**
		Lab Code:	K9708126-001	K9708126-002	K9708126-003
		Date Analyzed:	11/7/97	11/7/97	11/7/97
Analyte	**EPA Method**	**MRL**			
Antimony	200.8	0.02	0.17	0.93	0.08
Arsenic	200.8	0.5	8.1	7.7	6.3
Beryllium	200.8	0.02	0.33	0.41	0.39
Cadmium	200.8	0.02	0.60	0.61	0.22
Chromium	200.8	0.2	66.0	88.0	73.0
Copper	200.8	0.1	97.6	212	68.1
Lead	200.8	0.02	67.3	208	36.3
Mercury	7471A	0.02	1.87	2.01	0.75
Nickel	200.8	0.2	40.6	39.2	41.0
Selenium	200.8	1	2	2	ND
Silver	200.8	0.02	0.24	0.68	0.59
Thallium	200.8	0.02	0.09	0.09	0.07
Zinc	200.8	0.5	106	1450	95.2

Approved By: JC Date: 11/10/97

3S30EPA/102094
08126ICP.GJ1 - Sample 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.		**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor		**Date Collected:**	10/31/97
Sample Matrix:	Sediment		**Date Received:**	11/3/97
			Date Extracted:	11/5/97

Total Metals
Units: mg/Kg (ppm)
Dry Weight Basis

Analyte	EPA Method	MRL	Sta-4	Sta-5	Sta-6
		Sample Name:	**Sta-4**	**Sta-5**	**Sta-6**
		Lab Code:	K9708126-004	K9708126-005	K9708126-006
		Date Analyzed:	11/7/97	11/7/97	11/7/97
Antimony	200.8	0.02	0.04	0.04	0.07
Arsenic	200.8	0.5	5.0	3.4	4.1
Beryllium	200.8	0.02	0.42	0.50	0.47
Cadmium	200.8	0.02	0.18	0.17	0.10
Chromium	200.8	0.2	70.4	86.8	63.7
Copper	200.8	0.1	39.6	55.8	37.9
Lead	200.8	0.02	19.9	33.2	19.2
Mercury	7471A	0.02	0.34	0.84	0.27
Nickel	200.8	0.2	40.4	47.7	40.2
Selenium	200.8	1	ND	1	1
Silver	200.8	0.02	0.33	0.42	0.20
Thallium	200.8	0.02	0.07	0.07	0.07
Zinc	200.8	0.5	76.2	115	72.4

Approved By: JC   Date: 11/10/97

3S30EPA/102094
0K126ICP.GJ1 - Sample (2) 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date Extracted:	11/5/97

Total Metals
Units: mg/Kg (ppm)
Dry Weight Basis

		Sample Name:	**Sta-7**	**Sta-8**	**Sta-9**
		Lab Code:	K9708126-007	K9708126-008	K9708126-009
		Date Analyzed:	11/7/97	11/7/97	11/7/97
Analyte	**EPA Method**	**MRL**			
Antimony	200.8	0.02	0.03	0.09	0.07
Arsenic	200.8	0.5	5.4	4.0	7.4
Beryllium	200.8	0.02	0.36	0.14	0.48
Cadmium	200.8	0.02	0.07	0.07	0.29
Chromium	200.8	0.2	69.9	24.6	86.0
Copper	200.8	0.1	24.0	12.2	40.7
Lead	200.8	0.02	1.86	7.48	30.4
Mercury	7471A	0.02	0.03	0.21	0.68
Nickel	200.8	0.2	44.5	23.1	48.8
Selenium	200.8	1	1	ND	1
Silver	200.8	0.02	0.10	0.08	0.54
Thallium	200.8	0.02	0.09	0.09	0.09
Zinc	200.8	0.5	40.5	25.4	82.5

Approved By: JC Date: 11/10/97

3S30EPA/102094
0K126ICP.GJ1 - Sample (3) 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: 11/5/97

Total Metals
Units: mg/Kg (ppm)
Dry Weight Basis

		Sample Name:	**Sta-10**	**Reference**	**Method Blank**
		Lab Code:	K9708126-010	K9708126-011	K9708126-MB
		Date Analyzed:	11/7/97	11/7/97	11/7/97
Analyte	**EPA Method**	**MRL**			
Antimony	200.8	0.02	0.09	0.05	ND
Arsenic	200.8	0.5	3.9	2.3	ND
Beryllium	200.8	0.02	0.14	ND	ND
Cadmium	200.8	0.02	0.07	0.06	ND
Chromium	200.8	0.2	31.5	9.4	ND
Copper	200.8	0.1	10.1	2.6	ND
Lead	200.8	0.02	67.6	1.26	0.03
Mercury	7471A	0.02	0.06	ND	ND
Nickel	200.8	0.2	23.9	21.0	ND
Selenium	200.8	1	ND	ND	ND
Silver	200.8	0.02	0.13	0.06	ND
Thallium	200.8	0.02	0.04	ND	ND
Zinc	200.8	0.5	165	6.2	1.0

Approved By: JC Date: 11/10/97

3S30EPA/102094
08126ICP.GJ1 - Sample (4) 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeporting - Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date TCLP Performed:	11/4/97
		Date Extracted:	11/5/97

Toxicity Characteristic Leaching Procedure (TCLP)
EPA Method 1311
Metals
Units: mg/L (ppm) in TCLP Extract

			Sample Name:	**Sta-1-2-B**	**Sta-1-2-T**	**Sta-3**
			Lab Code:	K9708126-001	K9708126-002	K9708126-003
			Date Analyzed:	11/6/97	11/6/97	11/6/97
Analyte	**EPA Method**	**MRL**	**Regulatory Limit***			
Antimony	3010A/6010A	0.1	-	ND	ND	ND
Arsenic	3010A/6010A	0.1	5	ND	ND	ND
Beryllium	3010A/6010A	0.01	-	ND	ND	ND
Cadmium	3010A/6010A	0.01	1	ND	ND	ND
Chromium	3010A/6010A	0.01	5	ND	ND	ND
Copper	3010A/6010A	0.05	-	ND	ND	ND
Lead	3010A/6010A	0.05	5	ND	ND	ND
Mercury	7470A	0.001	0.2	ND	ND	ND
Nickel	3010A/6010A	0.05	-	ND	ND	ND
Selenium	3010A/6010A	0.1	1	ND	ND	ND
Silver	3010A/6010A	0.01	5	ND	ND	ND
Thallium	3010A/6010A	0.2	-	ND	ND	ND
Zinc	3010A/6010A	0.5	-	ND	ND	ND

* From 40 CFR Part 261, et al., and *Federal Register*, March 29, 1990 and June 29, 1990.

Approved By: JC Date: 11/10/97

TCLP/102194
08126ICP.JC1 - Sample 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeporting - Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date TCLP Performed:	11/4/97
		Date Extracted:	11/5/97

Toxicity Characteristic Leaching Procedure (TCLP)
EPA Method 1311
Metals
Units: mg/L (ppm) in TCLP Extract

			Sample Name:	Sta-4	Sta-5	Sta-6
			Lab Code:	K9708126-004	K9708126-005	K9708126-006
			Date Analyzed:	11/6/97	11/6/97	11/6/97
Analyte	**EPA Method**	**MRL**	**Regulatory Limit***			
Antimony	3010A/6010A	0.1	-	ND	ND	ND
Arsenic	3010A/6010A	0.1	5	ND	ND	ND
Beryllium	3010A/6010A	0.01	-	ND	ND	ND
Cadmium	3010A/6010A	0.01	1	ND	ND	ND
Chromium	3010A/6010A	0.01	5	ND	ND	ND
Copper	3010A/6010A	0.05	-	ND	ND	ND
Lead	3010A/6010A	0.05	5	ND	ND	ND
Mercury	7470A	0.001	0.2	ND	ND	ND
Nickel	3010A/6010A	0.05	-	ND	ND	ND
Selenium	3010A/6010A	0.1	1	ND	ND	ND
Silver	3010A/6010A	0.01	5	ND	ND	ND
Thallium	3010A/6010A	0.2	-	ND	ND	ND
Zinc	3010A/6010A	0.5	-	ND	ND	ND

* From 40 CFR Part 261, et al., and *Federal Register*, March 29, 1990 and June 29, 1990.

Approved By: JC Date: 11/10/97

TCLP/102194
0K126ICP.JC1 - Sample (2) 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeporting - Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date TCLP Performed:	11/4/97
		Date Extracted:	11/5/97

Toxicity Characteristic Leaching Procedure (TCLP)
EPA Method 1311
Metals
Units: mg/L (ppm) in TCLP Extract

			Sample Name:	Sta-7	Sta-8	Sta-9
			Lab Code:	K9708126-007	K9708126-008	K9708126-009
			Date Analyzed:	11/6/97	11/6/97	11/6/97
Analyte	**EPA Method**	**MRL**	**Regulatory Limit***			
Antimony	3010A/6010A	0.1	-	ND	ND	ND
Arsenic	3010A/6010A	0.1	5	ND	ND	ND
Beryllium	3010A/6010A	0.01	-	ND	ND	ND
Cadmium	3010A/6010A	0.01	1	ND	ND	ND
Chromium	3010A/6010A	0.01	5	ND	ND	ND
Copper	3010A/6010A	0.05	-	ND	ND	ND
Lead	3010A/6010A	0.05	5	ND	ND	ND
Mercury	7470A	0.001	0.2	ND	ND	ND
Nickel	3010A/6010A	0.05	-	ND	ND	ND
Selenium	3010A/6010A	0.1	1	ND	ND	ND
Silver	3010A/6010A	0.01	5	ND	ND	ND
Thallium	3010A/6010A	0.2	-	ND	ND	ND
Zinc	3010A/6010A	0.5	-	ND	ND	ND

* From 40 CFR Part 261, et al., and *Federal Register*, March 29, 1990 and June 29, 1990.

Approved By: JC Date: 11/10/97

TCLP/102194
0K126ICP.JC1 - Sample (3) 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeporting - Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date TCLP Performed:	11/4/97
		Date Extracted:	11/5/97

Toxicity Characteristic Leaching Procedure (TCLP)
EPA Method 1311
Metals
Units: mg/L (ppm) in TCLP Extract

			Sample Name:	Sta-10	Sta-Reference	Method Blank
			Lab Code:	K9708126-010	K9708126-011	K9706537-MB
			Date Analyzed:	11/6/97	11/6/97	11/6/97
Analyte	**EPA Method**	**MRL**	**Regulatory Limit***			
Antimony	3010A/6010A	0.1	-	ND	ND	ND
Arsenic	3010A/6010A	0.1	5	ND	ND	ND
Beryllium	3010A/6010A	0.01	-	ND	ND	ND
Cadmium	3010A/6010A	0.01	1	ND	ND	ND
Chromium	3010A/6010A	0.01	5	ND	[illegible]	ND
Copper	3010A/6010A	0.05	-	ND	[illegible]	ND
Lead	3010A/6010A	0.05	5	ND	[illegible]	ND
Mercury	7470A	0.001	0.2	ND	[illegible]	ND
Nickel	3010A/6010A	0.05	-	ND	[illegible]	ND
Selenium	3010A/6010A	0.1	1	[illegible]	[illegible]	ND
Silver	3010A/6010A	0.01	[illegible]	[illegible]	[illegible]	ND
Thallium	3010A/6010A	0.2	[illegible]	[illegible]	[illegible]	ND
Zinc	3010A/6010A	0.5	[illegible]	[illegible]	[illegible]	ND

AQUATIC CONSULTING & TESTING, INC.
Phone: (602) 921-8044 Fax: (602) 921-0049

Appendix D
Analytical Chem

* From 40 CFR Part 261, et al., and *Federal Regi[illegible]* [illegible], 1990 and June 29, 1990.

Approved By: JC Date: 11/10/97

TCLP/102194
0K126ICP.JC1 - Sample (4) 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: 11/10/97
Date Analyzed: 11/11/97

Petroleum Hydrocarbons
EPA Methods 9071/418.1
Units: mg/Kg (ppm)
Dry Weight Basis

Sample Name	Lab Code	MRL	Result
Sta-1-2-B	K9708126-001	20	623
Sta-1-2-T	K9708126-002	20	1000
Sta-3	K9708126-003	20	291
Sta-4	K9708126-004	20	271
Sta-5	K9708126-005	20	643
Sta-6	K9708126-006	20	166
Sta-7	K9708126-007	20	21
Sta-8	K9708126-008	20	104
Sta-9	K9708126-009	20	1330
Sta-10	K9708126-010	20	66
Reference	K9708126-011	20	ND
Method Blank	K971110-MB	20	ND

Approved By: ____ Date: 11/12/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date Extracted:	11/4/97

Organochlorine Pesticides and Polychlorinated Biphenyls

Units:	ug/Kg (ppb)	Sample Name:	**Sta-1-2-B**	**Sta-1-2-T**	**Sta-3**
Basis:	Dry	Lab Code:	K9708126-001	K9708126-002	K9708126-003
Methods:	EPA 3550A/8080	Date Analyzed:	11/7/97	11/7-9/97	11/8-9/97

Analyte	**MRL**	Sta-1-2-B	Sta-1-2-T	Sta-3
alpha-BHC	2	ND	ND	ND
beta-BHC	2	ND	ND	ND
gamma-BHC(Lindane)	2	ND	ND	ND
delta-BHC	2	ND	ND	ND
Heptachlor	2	ND	ND	ND
Aldrin	2	ND	ND	ND
Heptachlor Epoxide	2	ND	ND	ND
Endosulfan I	2	ND	ND	ND
Dieldrin	2	ND	ND	ND
4,4'-DDE	2	ND	3	ND
Endrin	2	ND	ND	ND
Endosulfan II	2	ND	ND	ND
4,4'-DDD	2	ND	ND	ND
Endrin Aldehyde	2	ND	ND	<3 (B)
Endosulfan Sulfate	2	ND	ND	ND
4,4'-DDT	2	ND	ND	ND
Endrin Ketone	2	ND	ND	ND
Methoxychlor	4	ND	ND	ND
Chlordane	10	ND	<15 (B)	ND
Toxaphene	30	ND	<300 (B)	<70 (B)
Aroclor 1016	10	ND	ND	ND
Aroclor 1221	10	ND	ND	ND
Aroclor 1232	10	ND	ND	ND
Aroclor 1242	10	ND	ND	ND
Aroclor 1248	10	ND	ND	ND
Aroclor 1254	10	ND	79	ND
Aroclor 1260	10	ND	238	95

B The MRL is elevated because of matrix interferences.

Approved By: ______ Date: 11/14/97

08126SVG.LP1 - STD 1-3 11/13/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: 11/4/97

Organochlorine Pesticides and Polychlorinated Biphenyls

Units: ug/Kg (ppb)
Basis: Dry
Methods: EPA 3550A/8080

		Sample Name:	Sta-4	Sta-5	Sta-6
		Lab Code:	K9708126-004	K9708126-005	K9708126-006
		Date Analyzed:	11/9/97	11/9/97	11/9/97
Analyte	**MRL**				
alpha-BHC	2		ND	ND	ND
beta-BHC	2		ND	ND	ND
gamma-BHC(Lindane)	2		ND	ND	ND
delta-BHC	2		ND	ND	ND
Heptachlor	2		ND	ND	ND
Aldrin	2		ND	ND	ND
Heptachlor Epoxide	2		ND	ND	ND
Endosulfan I	2		ND	ND	ND
Dieldrin	2		ND	ND	ND
4,4'-DDE	2		ND	ND	ND
Endrin	2		ND	ND	ND
Endosulfan II	2		ND	ND	ND
4,4'-DDD	2		ND	ND	ND
Endrin Aldehyde	2		ND	3	ND
Endosulfan Sulfate	2		ND	ND	ND
4,4'-DDT	2		ND	ND	ND
Endrin Ketone	2		ND	ND	ND
Methoxychlor	4		ND	ND	ND
Chlordane	10		ND	ND	ND
Toxaphene	30		<50 (B)	<80 (B)	<45 (B)
Aroclor 1016	10		ND	ND	ND
Aroclor 1221	10		ND	ND	ND
Aroclor 1232	10		ND	ND	ND
Aroclor 1242	10		ND	ND	ND
Aroclor 1248	10		ND	ND	ND
Aroclor 1254	10		ND	ND	ND
Aroclor 1260	10		70	110	64

B The MRL is elevated because of matrix interferences.

Approved By: LAH Date: 11/14/97

0S126SVG.LP1 - STD 4-6 11/13/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date Extracted:	11/4/97

Organochlorine Pesticides and Polychlorinated Biphenyls

Units:	ug/Kg (ppb)	Sample Name:	**Sta-7**	**Sta-8**	**Sta-9**
Basis:	Dry	Lab Code:	K9708126-007	K9708126-008	K9708126-009
Methods:	EPA 3550A/8080	Date Analyzed:	11/9/97	11/9/97	11/9/97

Analyte	**MRL**	Sta-7	Sta-8	Sta-9
alpha-BHC	2	ND	ND	ND
beta-BHC	2	ND	ND	ND
gamma-BHC(Lindane)	2	ND	ND	ND
delta-BHC	2	ND	ND	ND
Heptachlor	2	ND	ND	ND
Aldrin	2	ND	ND	ND
Heptachlor Epoxide	2	ND	ND	ND
Endosulfan I	2	ND	ND	ND
Dieldrin	2	ND	ND	ND
4,4'-DDE	2	ND	ND	ND
Endrin	2	ND	ND	ND
Endosulfan II	2	ND	ND	ND
4,4'-DDD	2	ND	ND	ND
Endrin Aldehyde	2	ND	ND	ND
Endosulfan Sulfate	2	ND	ND	ND
4,4'-DDT	2	ND	ND	ND
Endrin Ketone	2	ND	ND	ND
Methoxychlor	4	14	ND	ND
Chlordane	10	ND	ND	ND
Toxaphene	30	ND	ND	<40 (B)
Aroclor 1016	10	ND	ND	ND
Aroclor 1221	10	ND	ND	ND
Aroclor 1232	10	ND	ND	ND
Aroclor 1242	10	ND	ND	ND
Aroclor 1248	10	ND	ND	ND
Aroclor 1254	10	ND	ND	ND
Aroclor 1260	10	ND	30	50

B The MRL is elevated because of matrix interferences.

Approved By: VM Date: 11/14/97

08126SVG.LP2 - STD 1-3 11/14/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date Extracted:	11/4/97

Organochlorine Pesticides and Polychlorinated Biphenyls

Units:	ug/Kg (ppb)	Sample Name:	**Sta-10**	**Reference**	**Method Blank**
Basis:	Dry	Lab Code:	K9708126-010	K9708126-011	KWG9703407-4
Methods:	EPA 3550A/8080	Date Analyzed:	11/9/97	11/9/97	11/7/97

Analyte	**MRL**	Sta-10	Reference	Method Blank
alpha-BHC	2	ND	ND	ND
beta-BHC	2	ND	ND	ND
gamma-BHC(Lindane)	2	ND	ND	ND
delta-BHC	2	ND	ND	ND
Heptachlor	2	ND	ND	ND
Aldrin	2	ND	ND	ND
Heptachlor Epoxide	2	ND	ND	ND
Endosulfan I	2	ND	ND	ND
Dieldrin	2	ND	ND	ND
4,4'-DDE	2	ND	ND	ND
Endrin	2	ND	ND	ND
Endosulfan II	2	ND	ND	ND
4,4'-DDD	2	ND	ND	ND
Endrin Aldehyde	2	ND	ND	ND
Endosulfan Sulfate	2	ND	ND	ND
4,4'-DDT	2	ND	ND	ND
Endrin Ketone	2	ND	ND	ND
Methoxychlor	4	ND	ND	ND
Chlordane	10	ND	ND	ND
Toxaphene	30	ND	ND	ND
Aroclor 1016	10	ND	ND	ND
Aroclor 1221	10	ND	ND	ND
Aroclor 1232	10	ND	ND	ND
Aroclor 1242	10	ND	ND	ND
Aroclor 1248	10	ND	ND	ND
Aroclor 1254	10	ND	ND	ND
Aroclor 1260	10	ND	ND	ND

Approved By: ________ LAH Date: 11/14/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97

Butyltins

Sample Name:	Sta-1-2-B	Units:	ug/Kg (ppb)
Lab Code:	K9708126-001	Basis:	Dry
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	2	
Di-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	2	
n-Butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	

Approved By: [signature] Date: 11/14/97

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97

Butyltins

Sample Name:	Sta-1-2-T	Units:	ug/Kg (ppb)
Lab Code:	K9708126-002	Basis:	Dry
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	41	
Di-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	25	
n-Butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/8/97	11/10/97	ND	

Approved By: Bo Date: 11/14/97

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97

Butyltins

Sample Name:	Sta-3	Units:	ug/Kg (ppb)
Lab Code:	K9708126-003	Basis:	Dry
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	10	
Di-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	16	
n-Butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/8/97	11/10/97	ND	

Approved By: Bo Date: 11/14/97

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97

Butyltins

Sample Name:	Sta-4	Units:	ug/Kg (ppb)
Lab Code:	K9708126-004	Basis:	Dry
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	4	
Di-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	3	
n-Butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	

Approved By: TJ Date: 11/14/97

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97

Butyltins

Sample Name:	Sta-5	Units:	ug/Kg (ppb)
Lab Code:	K9708126-005	Basis:	Dry
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	2	
Di-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	4	
n-Butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	

Approved By: TG Date: 11/14/97

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97

Butyltins

Sample Name: Sta-6
Lab Code: K9708126-006
Test Notes:

Units: ug/Kg (ppb)
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	5	
Di-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	4	
n-Butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	

Approved By: Date: 11/14/97

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97

Butyltins

Sample Name: Sta-7
Lab Code: K9708126-007
Test Notes:

Units: ug/Kg (ppb)
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	
Di-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	
n-Butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	

Approved By: 19 Date: 11/14/97

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97

Butyltins

Sample Name: Sta-8
Lab Code: K9708126-008
Test Notes:

Units: ug/Kg (ppb)
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	2	
Di-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	2	
n-Butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	

Approved By: TG Date: 11/14/97

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97

Butyltins

Sample Name:	Sta-9	Units:	ug/Kg (ppb)
Lab Code:	K9708126-009	Basis:	Dry
Test Notes:			

Analyte	**Prep Method**	**Analysis Method**	**MRL**	**Dilution Factor**	**Date Extracted**	**Date Analyzed**	**Result**	**Result Notes**
Tri-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	5	
Di-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	3	
n-Butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	

Approved By: TJ Date: 11/14/97

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97

Butyltins

Sample Name:	Sta-10	Units:	ug/Kg (ppb)
Lab Code:	K9708126-010	Basis:	Dry
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	
Di-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	
n-Butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	

Approved By: TG Date: 11/14/97

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97

Butyltins

Sample Name:	Reference	Units:	ug/Kg (ppb)
Lab Code:	K9708126-011	Basis:	Dry
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	1	
Di-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	
n-Butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/8/97	11/10/97	ND	

Approved By: Bo Date: 11/14/97

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: NA
Date Received: NA

Butyltins

Sample Name: Method Blank
Lab Code: K971104-SB
Test Notes:

Units: ug/Kg (ppb)
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
Tri-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	
Di-n-butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	ND	
n-Butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/4/97	11/7/97	8	

Approved By: ______ Date: 11/14/97

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08126SVG.JS1 - MB 11/14/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	NA
Sample Matrix:	Sediment	**Date Received:**	NA

Butyltins

Sample Name:	Method Blank	Units:	ug/Kg (ppb)
Lab Code:	K971108-SB	Basis:	Dry
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Dilution Factor	Date Extracted	Date Analyzed	Result	Result Notes
n-Butyltin	C.A.Krone et al.	TIN-SVG	1	1	11/8/97	11/10/97	39	

Approved By: TJ Date: 11/14/97

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

[redacted]lient:	MEC Analytical Systems, Inc.	Service Request:	K9708126
[redacted]roject:	Homeport-Pearl Harbor	Date Collected:	10/31/97
Sample Matrix:	Sediment	Date Received:	11/3/97
		Date Extracted:	11/4/97

Base Neutral/Acid Semivolatile Organic Compound

[redacted]nits:	ug/kg		
Basis:	Dry		
Methods:	EPA 3550A/SIM		

Analyte	MRL	Sample Name: Sta-1-2-B Lab Code: K9708126-001 Date Analyzed: 11/10/97	Sta-1-2-T K9708126-002 11/10/97	Sta-3 K9708126-003 11/10/97
Phenol	50	ND	67	ND
[redacted]-Chlorophenol	50	ND	ND	ND
[redacted]-Nitrophenol	40	ND	ND	ND
2,4-Dimethylphenol	200	ND	ND	ND
2,4-Dichlorophenol	100	ND	ND	ND
[redacted]aphthalene	20	ND	24	ND
[redacted]-Chloro-3-methylphenol	50	ND	ND	ND
2,4,6-Trichlorophenol	30	ND	ND	ND
Acenaphthylene	20	ND	27	ND
[redacted]imethyl Phthalate	10	ND	ND	ND
[redacted]cenaphthene	10	ND	107	ND
2,4-Dinitrophenol	300	ND	ND	ND
4-Nitrophenol	100	ND	ND	ND
[redacted]luorene	20	ND	136	ND
[redacted]iethyl Phthalate	10	ND	ND	ND
2-Methyl-4,6-dinitrophenol	100	ND	ND	ND
Pentachlorophenol	300	ND	ND	ND
[redacted]henanthrene	20	44	2300	21
[redacted]nthracene	20	ND	700	ND
Di-n-butyl Phthalate	10	ND	56	32
Fluoranthene	20	109	5100	78
[redacted]yrene	20	140	4300	87
[redacted]utyl Benzyl Phthalate	10	ND	ND	ND
Benz(a)anthracene	20	46	2100	50
Chrysene	20	53	2100	64
[redacted]is(2-ethylhexyl) Phthalate	200	ND	360	240
[redacted]i-n-octyl Phthalate	10	ND	ND	ND
Benzo(b)fluoranthene	20	129	2100	200
Benzo(k)fluoranthene	20	42	1800	65
[redacted]enzo(a)pyrene	20	88	2100	131
[redacted]deno(1,2,3-cd)pyrene	20	38	1200	77
Dibenz(a,h)anthracene	20	ND	190	20
Benzo(g,h,i)perylene	20	36	1000	66

[redacted]pproved By: ______ Date: 11·13·97

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COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date Extracted:	11/4/97

Base Neutral/Acid Semivolatile Organic Compound

Units:	ug/kg	Sample Name:	**Sta-4**	**Sta-5**	**Sta-6**
Basis:	Dry	Lab Code:	K9708126-004	K9708126-005	K9708126-006
Methods:	EPA 3550A/SIM	Date Analyzed:	11/10/97	11/10/97	11/10/97

Analyte	**MRL**	Sta-4	Sta-5	Sta-6
Phenol	50	ND	ND	ND
2-Chlorophenol	50	ND	ND	ND
2-Nitrophenol	40	ND	ND	ND
2,4-Dimethylphenol	200	ND	ND	ND
2,4-Dichlorophenol	100	ND	ND	ND
Naphthalene	20	ND	ND	ND
4-Chloro-3-methylphenol	50	ND	ND	ND
2,4,6-Trichlorophenol	30	ND	ND	ND
Acenaphthylene	20	ND	ND	ND
Dimethyl Phthalate	10	ND	ND	ND
Acenaphthene	10	ND	ND	ND
2,4-Dinitrophenol	300	ND	ND	ND
4-Nitrophenol	100	ND	ND	ND
Fluorene	20	ND	ND	ND
Diethyl Phthalate	10	ND	ND	ND
2-Methyl-4,6-dinitrophenol	100	ND	ND	ND
Pentachlorophenol	300	ND	ND	ND
Phenanthrene	20	ND	ND	ND
Anthracene	20	ND	ND	ND
Di-n-butyl Phthalate	10	37	ND	15
Fluoranthene	20	26	38	21
Pyrene	20	30	48	23
Butyl Benzyl Phthalate	10	ND	ND	ND
Benz(a)anthracene	20	ND	ND	ND
Chrysene	20	22	27	22
Bis(2-ethylhexyl) Phthalate	200	ND	ND	ND
Di-n-octyl Phthalate	10	ND	ND	ND
Benzo(b)fluoranthene	20	92	151	83
Benzo(k)fluoranthene	20	29	48	28
Benzo(a)pyrene	20	51	84	48
Indeno(1,2,3-cd)pyrene	20	32	46	26
Dibenz(a,h)anthracene	20	ND	ND	ND
Benzo(g,h,i)perylene	20	30	42	23

Approved By: LAH Date: 11/14/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: 11/4/97

Base Neutral/Acid Semivolatile Organic Compound

Units: ug/kg
Basis: Dry
Methods: EPA 3550A/SIM

		Sample Name:	Sta-7	Sta-8	Sta-9
		Lab Code:	K9708126-007	K9708126-008	K9708126-009
		Date Analyzed:	11/10/97	11/11/97	11/11/97
Analyte	**MRL**				
Phenol	50		ND	ND	ND
2-Chlorophenol	50		ND	ND	ND
2-Nitrophenol	40		ND	ND	ND
2,4-Dimethylphenol	200		ND	ND	ND
2,4-Dichlorophenol	100		ND	ND	ND
Naphthalene	20		ND	ND	ND
4-Chloro-3-methylphenol	50		ND	ND	ND
2,4,6-Trichlorophenol	30		ND	ND	ND
Acenaphthylene	20		ND	ND	ND
Dimethyl Phthalate	10		ND	ND	ND
Acenaphthene	10		ND	ND	ND
2,4-Dinitrophenol	300		ND	ND	ND
4-Nitrophenol	100		ND	ND	ND
Fluorene	20		ND	ND	ND
Diethyl Phthalate	10		ND	ND	ND
2-Methyl-4,6-dinitrophenol	100		ND	ND	ND
Pentachlorophenol	300		ND	ND	ND
Phenanthrene	20		ND	ND	ND
Anthracene	20		ND	ND	ND
Di-n-butyl Phthalate	20		41	22	48
Fluoranthene	20		ND	ND	55
Pyrene	10		ND	ND	71
Butyl Benzyl Phthalate	20		ND	ND	ND
Benz(a)anthracene	20		ND	ND	37
Chrysene	200		ND	ND	45
Bis(2-ethylhexyl) Phthalate	10		ND	ND	ND
Di-n-octyl Phthalate	20		ND	38	ND
Benzo(b)fluoranthene	20		ND	ND	148
Benzo(k)fluoranthene	20		ND	23	47
Benzo(a)pyrene	20		ND	ND	97
Indeno(1,2,3-cd)pyrene	20		ND	ND	44
Dibenz(a,h)anthracene	20		ND	ND	ND
Benzo(g,h,i)perylene	20		ND	ND	49

Approved By: PM　　Date: 11·13·97

08126SVM.AY2 - STD 1-3 11/13/97

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date Extracted:	11/4/97

Base Neutral/Acid Semivolatile Organic Compound

Units:	ug/kg	Sample Name:	**Sta-10**	**Reference**	**Method Blank**
Basis:	Dry	Lab Code:	K9708126-010	K9708126-011	KWG9703390-4
Methods:	EPA 3550A/SIM	Date Analyzed:	11/11/97	11/7/97	11/7/97

Analyte	**MRL**	Sta-10	Reference	Method Blank
Phenol	50	ND	ND	ND
2-Chlorophenol	50	ND	ND	ND
2-Nitrophenol	40	ND	ND	ND
2,4-Dimethylphenol	200	ND	ND	ND
2,4-Dichlorophenol	100	ND	ND	ND
Naphthalene	20	ND	ND	ND
4-Chloro-3-methylphenol	50	ND	ND	ND
2,4,6-Trichlorophenol	30	ND	ND	ND
Acenaphthylene	20	ND	ND	ND
Dimethyl Phthalate	10	ND	ND	ND
Acenaphthene	10	ND	ND	ND
2,4-Dinitrophenol	300	ND	ND	ND
4-Nitrophenol	100	ND	ND	ND
Fluorene	20	ND	ND	ND
Diethyl Phthalate	10	ND	ND	ND
2-Methyl-4,6-dinitrophenol	100	ND	ND	ND
Pentachlorophenol	300	ND	ND	ND
Phenanthrene	20	ND	ND	ND
Anthracene	20	ND	ND	ND
Di-n-butyl Phthalate	20	ND	20	ND
Fluoranthene	20	ND	ND	ND
Pyrene	10	ND	ND	ND
Butyl Benzyl Phthalate	20	ND	ND	ND
Benz(a)anthracene	20	ND	ND	ND
Chrysene	200	ND	ND	ND
Bis(2-ethylhexyl) Phthalate	10	ND	ND	ND
Di-n-octyl Phthalate	20	ND	ND	ND
Benzo(b)fluoranthene	20	41	ND	ND
Benzo(k)fluoranthene	20	ND	ND	ND
Benzo(a)pyrene	20	25	ND	ND
Indeno(1,2,3-cd)pyrene	20	ND	ND	ND
Dibenz(a,h)anthracene	20	ND	ND	ND
Benzo(g,h,i)perylene	20	ND	ND	ND

Approved By: Dm Date: 11-13-97

081269VM.AY2 - STD 4-6 11/13/97

APPENDIX A

LABORATORY QA/QC RESULTS

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97

Duplicate Summary

Total Solids

Prep Method: NONE
Analysis Method: 160.3M
Test Notes:

Units: PERCENT
Basis: NA

Sample Name	Lab Code	Date Analyzed	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference	Result Notes
Sta-1-2-B	K9708126-001DUP	11/4/97	58.6	48.4	53.5	19	

Approved By: _____ Date: 11/6/97

TSDup/021397a

08126TS.AG1 - DUP 11/5/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: NA
Date Analyzed: 11/5/97

Duplicate Summary
Sulfide, Dissolved
EPA Method 376.2 Modified
Units: mg/Kg (ppm)
Dry Weight Basis

Sample Name	Lab Code	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Sta-1-2-B	K9708126-001D	3.0	ND	ND	ND	-

Approved By: _______________ Date: 11/10/97

DUP1A/102194
08126WET.MR1 - DUP 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date Extracted:	NA
		Date Analyzed:	11/5/97

Matrix Spike Summary
Sulfide, Dissolved
EPA Method 376.2 Modified
Units: mg/Kg (ppm)
Dry Weight Basis

Sample Name	Lab Code	MRL	Spike Level	Sample Result	Spiked Sample Result	Percent Recovery	CAS Percent Recovery Acceptance Limits
Sta-1-2-B	K9708126-001MS	3.0	203	ND	117	58	-

Approved By: [signature] Date: 11/10/97

MS1A/102194
08126WET.MR1 - MS 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	NA
LCS Matrix:	Sediment	**Date Received:**	NA
		Date Extracted:	NA
		Date Analyzed:	11/5/97

Laboratory Control Sample Summary
Sulfide, Dissolved
EPA Method 376.2 Modified
Units: mg/L (ppm)

Analyte	**True Value**	**Result**	**Percent Recovery**	**CAS Percent Recovery Acceptance Limits**
Sulfide, Dissolved	4.86	3.84	79	-

Approved By: _______________ Date: 11/10/97

LCS/102194

08126WET.MR1 - LCS 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: 11/5/97
Date Analyzed: 11/7/97

Duplicate Summary
Total Metals
Units: mg/Kg (ppm)
Dry Weight Basis

Sample Name: Sta-10
Lab Code: K9708126-010

Analyte	EPA Method	MRL	Sample Result	Duplicate Sample Result	Average	Relative Percent Difference
Antimony	200.8	0.02	0.09	0.10	0.10	10
Arsenic	200.8	0.5	3.9	4.2	4.0	8
Beryllium	200.8	0.02	0.14	0.15	0.14	7
Cadmium	200.8	0.02	0.07	0.10	0.08	38
Chromium	200.8	0.2	31.5	32.9	32.2	4
Copper	200.8	0.1	10.1	10.7	10.4	6
Lead	200.8	0.02	67.6	57.2	62.4	17
Mercury	7471A	0.02	1.87	2.34	2.10	22
Nickel	200.8	0.2	23.9	25.1	24.5	5
Selenium	200.8	1	ND	ND	ND	-
Silver	200.8	0.02	0.13	0.13	0.13	<1
Thallium	200.8	0.02	0.04	0.04	0.04	<1
Zinc	200.8	0.5	165	111	138	39(A)

L Duplicate analysis was performed on Sample Sta-1-2-B; Lab Code K9708126-001.
A Outside acceptance limits; see case narrative.

Approved By: JC Date: 11/10/97

DUP1SEPA/102194

0X126ICP.GJ1 - DUP 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: 11/5/97
Date Analyzed: 11/7/97

Matrix Spike Summary
Total Metals
Units: mg/Kg (ppm)
Dry Weight Basis

Sample Name: Sta-10
Lab Code: K9708126-010

Analyte	**MRL**	**Spike Level**	**Sample Result**	**Spiked Sample Result**	**Percent Recovery**	**CAS Percent Recovery Acceptance Limits**
Antimony	0.02	36	0.09	7.97	22(A)	30-130
Arsenic	0.5	14	3.9	16.9	93	60-130
Beryllium	0.02	3.6	0.14	3.46	92	60-130
Cadmium	0.02	3.6	0.07	3.17	86	60-130
Chromium	0.2	14	31.5	45.8	102	60-130
Copper	0.1	18	10.1	27.3	96	60-130
Lead	0.02	72	67.6	120	73	60-130
Mercury(M)	0.02	0.07	1.87	2.42	NA	60-130
Nickel	0.2	36	23.9	57.8	94	60-130
Selenium	1	7.2	ND	7	97	60-130
Silver	0.02	3.6	0.13	2.83	75	60-130
Thallium	0.02	7.2	0.04	7.55	104	60-130
Zinc	0.5	72	165	139	NA	60-130

NA Not Applicable; see case narrative.
A Outside acceptance limits; see case narrative.
M Matrix Spike analysis was performed on Sample Sta-1-2-B; Lab Code K9708126-001.

Approved By: _______ Date: 11/10/97

MS1S/102194
0K126ICP.GJ1 - Spike 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
LCS Matrix: Sediment

Service Request: K9708126
Date Collected: NA
Date Received: NA
Date Analyzed: 11/7/97

Laboratory Control Sample Summary
Total Metals
Units: mg/Kg (ppm)

Source: ERA Priority Pollutant/CLP Inorganic Soils

Analyte	**EPA Method**	**Result**	**Control Limits**
Antimony	200.8	29.0	12.2-90.1
Arsenic	200.8	50.4	43.9-81.5
Beryllium	200.8	72.8	67.0-107
Cadmium	200.8	64.7	51.4-130
Chromium	200.8	61.7	59.4-94.6
Copper	200.8	46.6	45.9-70.4
Lead	200.8	122	82.7-160
Mercury	7471A	2.33	1.60-3.41
Nickel	200.8	139	122-204
Selenium	200.8	72.2	65.5-118
Silver	200.8	70.8	51.4-87.7
Thallium	200.8	49.4	24.0-76.8
Zinc	200.8	112	84.1-144

Approved By: ____________ Date: 11/10/97

LCSEPA/102194
0K126ICP.GJ1 - ERA 230 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeporting - Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date TCLP Performed:	11/4/97
		Date Extracted:	11/5/97
		Date Analyzed:	11/6/97

Matrix Spike Summary
Toxicity Characteristic Leaching Procedure (TCLP)
EPA Method 1311
Metals
Units: mg/L (ppm) in TCLP Extract

Sample Name: Sta-1-2-B
Lab Code: K9708126-001

Analyte	**Spike Level**	**Sample Result**	**Spiked Sample Result**	**Percent Recovery***
Antimony	1	ND	0.96	96
Arsenic	4	ND	3.9	98
Beryllium	0.1	ND	0.10	100
Cadmium	0.1	ND	0.10	100
Chromium	0.4	ND	0.36	90
Copper	0.5	ND	0.49	98
Lead	1	ND	0.92	92
Mercury	0.01	ND	0.010	100
Nickel	1	ND	0.91	91
Selenium	2	ND	2.1	105
Silver	0.1	ND	0.09	90
Thallium	10	ND	9.1	91
Zinc	1	ND	1.12	112

* Percent recovery information is provided in order to assess the performance of the method on this matrix.

Approved By: JC Date: 11/10/97

TCLPMS - Spike 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeporting - Pearl Harbor	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Analyzed:	11/6/97

Laboratory Control Sample Summary
Total Metals
Units: mg/L (ppm) in TCLP Extract

Source: Inorganic Ventures ICV

Analyte	**EPA Method**	**True Value**	**Result**	**Percent Recovery**	**CAS Percent Recovery Acceptance Limits**
Antimony	3010A/6010A	2.5	2.6	104	85-115
Arsenic	3010A/6010A	2.5	2.4	96	85-115
Beryllium	3010A/6010A	0.125	0.123	98	85-115
Cadmium	3010A/6010A	1.25	1.22	98	85-115
Chromium	3010A/6010A	0.5	0.504	101	85-115
Copper	3010A/6010A	0.625	0.616	99	85-115
Lead	3010A/6010A	2.5	2.48	99	85-115
Mercury	7470A	0.01	0.011	110	85-115
Nickel	3010A/6010A	1.25	1.26	101	85-115
Selenium	3010A/6010A	2.5	2.4	96	85-115
Silver	3010A/6010A	0.625	0.584	93	85-115
Thallium	3010A/6010A	7.5	7.4	99	85-115
Zinc	3010A/6010A	1.25	1.19	95	85-115

Approved By: JC Date: 11/10/97

LCSEPA/102194
0X126ICP.JC1 - LCSW 11/10/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: 11/10/97
Date Analyzed: 11/11/97

Matrix Spike/Duplicate Matrix Spike Summary
Petroleum Hydrocarbons
EPA Methods 9071/418.1
Units: mg/Kg (ppm)
Dry Weight Basis

Sample Name: Sta-7
Lab Code: K9708126-007DMS

	Spike Level		Sample	Spike Result		Percent Recovery			Relative
								CAS Acceptance	Percent
Analyte	MS	DMS	**Result**	MS	DMS	MS	DMS	Limits	**Difference**
Oil	1400	1500	21	1310	1380	92	91	59-125	2

Approved By: ____ Date: 11/12/97

DMS1S/120594
0R126PHC.CR1 - DMS1S 11/12/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	NA
LCS Matrix:	Sediment	**Date Received:**	NA
		Date Extracted:	11/10/97
		Date Analyzed:	11/11/97

Laboratory Control Sample Summary
Petroleum Hydrocarbons
EPA Methods 9071/418.1
Units: mg/Kg (ppm)

Analyte	**True Value**	**Result**	**Percent Recovery**	**CAS Percent Recovery Acceptance Limits**
Oil	800	766	96	72-111

Approved By: Hup Date: 11/12/97

LCS/102194
0R126PHC.CR1 - 418sLCS 11/11/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: 11/4/97
Date Analyzed: 11/7 - 11/9/97

Surrogate Recovery Summary
Organochlorine Pesticides and Polychlorinated Biphenyls

Prep Method: EPA 3550A
Analysis Method: 8080

Units: Percent
Basis: Dry

Sample Name	Lab Code	Test Notes	Percent Recovery Tetrachloro-m-xylene	Percent Recovery Decachlorobiphenyl
Sta-1-2-B	K9708126-001		32	40
Sta-1-2-T	K9708126-002		25	56
Sta-3	K9708126-003		32	47
Sta-4	K9708126-004		43	58
Sta-5	K9708126-005		38	51
Sta-6	K9708126-006		38	46
Sta-7	K9708126-007		45	51
Sta-8	K9708126-008		46	52
Sta-9	K9708126-009		33	45
Sta-10	K9708126-010		41	47
Reference	K9708126-011		44	65
Method Blank	KWG9703407-4		50	95
Sta-7	K9708126-007MS		49	84
Sta-7	K9708126-007DMS		49	81
Lab Control Sample	KWG9703407-3		60	86
		CAS Acceptance Limits:	20-107	20-142

Approved By: LMH Date: 11/14/97

SUR2/021397a
08126SVG.LP3 - SUR 11/13/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date Extracted:	11/4/97
		Date Analyzed:	11/8/97

Matrix Spike/Duplicate Matrix Spike Summary
Organochlorine Pesticides and Polychlorinated Biphenyls

Sample Name: Sta-7 — Units: ug/Kg (ppb)
Lab Code: K9708126-007MS K9708126-007DMS — Basis: Dry
Test Notes:

									Percent Recovery				
											CAS	**Relative**	
	Prep	**Analysis**		**Spike Level**		**Sample**	**Spike Result**				Acceptance	**Percent**	**Result**
Analyte	**Method**	**Method**	**MRL**	MS	DMS	**Result**	MS	DMS	MS	DMS	Limits	**Difference**	**Notes**
Gamma-BHC(Lindane)	EPA 3550A	8080	2	11	11	ND	7	7	64	64	20-141	<1	
Heptachlor	EPA 3550A	8080	2	11	11	ND	7	7	64	64	20-108	<1	
Aldrin	EPA 3550A	8080	2	11	11	ND	6	6	55	55	20-181	<1	
Dieldrin	EPA 3550A	8080	2	11	11	ND	8	9	73	82	20-183	12	
Endrin	EPA 3550A	8080	2	11	11	ND	9	9	82	82	20-164	<1	
4,4'-DDT	EPA 3550A	8080	2	11	11	ND	7	8	64	73	20-185	13	

Approved By: UAl Date: 11/14/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
LCS Matrix: Sediment

Service Request: K9708126
Date Collected: NA
Date Received: NA
Date Extracted: 11/4/97
Date Analyzed: 11/7/97

Laboratory Control Sample Summary
Organochlorine Pesticides and Polychlorinated Biphenyls

Sample Name: Lab Control Sample
Lab Code: KWG9703407-3
Test Notes:

Units: ug/Kg (ppb)
Basis: Dry

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
gamma-BHC(Lindane)	EPA 3550A	8080	13	10	77	21-123	
Heptachlor	EPA 3550A	8080	13	9	69	31-112	
Aldrin	EPA 3550A	8080	13	9	69	26-127	
Dieldrin	EPA 3550A	8080	13	11	85	18-161	
Endrin	EPA 3550A	8080	13	11	85	32-135	
4,4'-DDT	EPA 3550A	8080	13	10	77	30-146	

Approved By: UMA Date: 11/14/97

LCS/031497a
0K126SVG.LP3 - LCS 11/13/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: 11/4/97
Date Analyzed: 11/7/97

Surrogate Recovery Summary
Butyltins

Prep Method: C.A.Krone et al.
Analysis Method: TIN-SVG

Units: PERCENT
Basis: NA

Sample Name	Lab Code	Test Notes	Percent Recovery Tri-n-propyltin	Tri-n-pentyltin
Sta-1-2-B	K9708126-001		115	89
Sta-1-2-T	K9708126-002		126	103
Sta-3	K9708126-003		143	104
Sta-4	K9708126-004		111	77
Sta-5	K9708126-005		116	84
Sta-6	K9708126-006		86	80
Sta-7	K9708126-007		49	48
Sta-8	K9708126-008		164	110
Sta-9	K9708126-009		211 A	136
Sta-10	K9708126-010		141	116
Reference	K9708126-011		177	127
Reference	K9708126-011MS		173	145
Reference	K9708126-011DMS		110	62
Lab Control Sample	K971104-SL		47	58
Method Blank	K971104-SB		131	115
CAS Acceptance Limits:			20-195	20-172

A Outside acceptance limits; see case narrative.

Approved By: BD Date: 11/14/97

SUR2/052595
08126SVG.JS1 - SUR 11/14/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: 11/8/97
Date Analyzed: 11/10/97

Surrogate Recovery Summary
Butyltins

Prep Method: C.A.Krone et al.
Analysis Method: TIN-SVG

Units: PERCENT
Basis: NA

Sample Name	Lab Code	Test Notes	Percent Recovery Tri-n-propyltin	Tri-n-pentyltin
Sta-1-2-T	K9708126-002R		68	67
Sta-3	K9708126-003R		95	88
Reference	K9708126-011R		86	76
Reference	K9708126-011MS		111	104
Reference	K9708126-011DMS		90	78
Lab Control Sample	K971108-SL		55	63
Method Blank	K971108-SB		118	110
		CAS Acceptance Limits:	20-195	20-172

Approved By: TO   Date: 11/14/97

SUR2/052595
08126SVG.JS4 - SUR 11/14/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: 11/4/97
Date Analyzed: 11/7/97

Matrix Spike/Duplicate Matrix Spike Summary
Butyltins

Sample Name: Reference
Lab Code: K9708126-011MS, K9708126-011DMS
Test Notes:

Units: ug/Kg (ppb)
Basis: Dry

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	CAS Acceptance Limits	Relative Percent Difference	Result Notes
Tri-n-butyltin	C.A.Krone et al	TIN-SVG	1	13	13	1	22	10	162	69	20-200	75	
Di-n-butyltin	C.A.Krone et al	TIN-SVG	1	13	13	ND	19	8	146	62	20-200	81	
n-Butyltin	C.A.Krone et al	TIN-SVG	1	13	13	1	4	3	23	15	20-200	29	

Approved By: _____ Date: 11/14/97

MS/052595

08126SVG.JS1 - DMS 11/14/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date Extracted:	11/8/97
		Date Analyzed:	11/10/97

Matrix Spike/Duplicate Matrix Spike Summary
Butyltins

Sample Name:	Reference	Units:	ug/Kg (ppb)
Lab Code:	K9708126-011MS, K9708126-011DMS	Basis:	Dry
Test Notes:			

Analyte	Prep Method	Analysis Method	MRL	Spike Level MS	Spike Level DMS	Sample Result	Spike Result MS	Spike Result DMS	Percent Recovery MS	Percent Recovery DMS	Percent Recovery CAS Acceptance Limits	Relative Percent Difference	Result Notes
Tri-n-butyltin	C.A.Krone et al	TIN-SVG	1	13	13	ND	15	12	115	92	20-200	22	
Di-n-butyltin	C.A.Krone et al	TIN-SVG	1	13	13	ND	13	11	100	85	20-200	17	
n-Butyltin	C.A.Krone et al	TIN-SVG	1	13	13	ND	0.1	0.04	<1	<1	20-200	86	A

A Outside acceptance limits; see case narrative.

Approved By: [signature] Date: 11/14/97

DMS/052595

08126SVG.JS4 - DMS 11/14/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
LCS Matrix: Sediment

Service Request: K9708126
Date Collected: NA
Date Received: NA
Date Extracted: 11/4/97
Date Analyzed: 11/7/97

Laboratory Control Sample Summary
Butyltins

Sample Name: Lab Control Sample
Lab Code: K971104-SL
Test Notes:

Units: ug/Kg (ppb)
Basis: Dry

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Tri-n-butyltin	C.A.Krone et al	TIN-SVG	10	6	60	20-164	
Di-n-butyltin	C.A.Krone et al	TIN-SVG	10	3	30	20-164	
n-Butyltin	C.A.Krone et al	TIN-SVG	10	1	10	20-164	A

A Outside acceptance limits; see case narrative.

Approved By: TG Date: 11/14/97

LCS/52595
08126SVG.JS1 - LCS 11/14/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
LCS Matrix: Sediment

Service Request: K9708126
Date Collected: NA
Date Received: NA
Date Extracted: 11/8/97
Date Analyzed: 11/10/97

Laboratory Control Sample Summary
Butyltins

Sample Name: Lab Control Sample
Lab Code: K971108-SL
Test Notes:

Units: ug/Kg (ppb)
Basis: Dry

Analyte	**Prep Method**	**Analysis Method**	**True Value**	**Result**	**Percent Recovery**	**CAS Percent Recovery Acceptance Limits**	**Result Notes**
Tri-n-butyltin	C.A.Krone et al	TIN-SVG	10	7	70	20-164	
Di-n-butyltin	C.A.Krone et al	TIN-SVG	10	7	70	20-164	
n-Butyltin	C.A.Krone et al	TIN-SVG	10	11	110	20-164	

Approved By: TG Date: 11/14/97

LCS/52595
08126SVG.JS4 - LCS 11/14/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
Sample Matrix: Sediment

Service Request: K9708126
Date Collected: 10/31/97
Date Received: 11/3/97
Date Extracted: 11/4/97
Date Analyzed: 11/7 - 11/11/97

Surrogate Recovery Summary
Base Neutral/Acid Semivolatile Organic Compound

Prep Method: EPA 3550A
Analysis Method: SIM

Units: Percent
Basis: Dry

Sample Name	Lab Code	Test Notes	Percent Recovery					
			2FP	PHL	NBZ	FBP	TBP	TPH
Sta-1-2-B	K9708126-001		86	91	83	76	104	126
Sta-1-2-T	K9708126-002		81	88	79	80	115 A	169 A
Sta-3	K9708126-003		84	86	82	85	117 A	147 A
Sta-4	K9708126-004		77	88	78	80	120 A	159 A
Sta-5	K9708126-005		75	81	80	73	99	155 A
Sta-6	K9708126-006		64	63	74	76	108	147 A
Sta-7	K9708126-007		65	68	81	77	111 A	130
Sta-8	K9708126-008		62	58	81	78	105	128
Sta-9	K9708126-009		51	55	64	68	95	139
Sta-10	K9708126-010		53	73	79	88	126 A	140
Reference	K9708126-011		84	84	80	77	85	98
Reference	K9708126-011MS		91	91	88	85	99	102
Reference	K9708126-011DMS		74	76	69	69	85	90
Lab Control Sample	KWG9703390-3		58	78	82	80	36	96
Method Blank	KWG9703390-4		44	69	88	82	15	104
CAS Acceptance Limits:			5-106	5-96	5-134	5-120	5-110	15-145

2FP 2-Fluorophenol
PHL Phenol-d5
NBZ Nitrobenzene-d5
FBP 2-Fluorobiphenyl
TBP 2,4,6-Tribromophenol
TPH Terphenyl-d14
A Outside acceptance limits; see case narrative.

Approved By: RMA Date: 11-13-97
SUR6/022897a

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	MEC Analytical Systems, Inc.	**Service Request:**	K9708126
Project:	Homeport-Pearl Harbor	**Date Collected:**	10/31/97
Sample Matrix:	Sediment	**Date Received:**	11/3/97
		Date Extracted:	11/4/97
		Date Analyzed:	11/7/97

Matrix Spike/Duplicate Matrix Spike Summary
Base Neutral/Acid Semivolatile Organic Compound

Sample Name:	Reference		Units:	ug/kg
Lab Code:	K9708126-011MS	K9708126-011DMS	Basis:	Dry
Test Notes:				

									Percent Recovery				
											CAS	**Relative**	
	Prep	**Analysis**		**Spike Level**		**Sample**	**Spike Result**				Acceptance	**Percent**	**Result**
Analyte	**Method**	**Method**	**MRL**	MS	DMS	**Result**	MS	DMS	MS	DMS	Limits	**Difference**	**Notes**
Phenol	EPA 3550A	SIM	50	270	270	ND	225	195	83	72	21-100	14	
2-Chlorophenol	EPA 3550A	SIM	50	270	270	ND	214	185	79	69	20-105	15	
4-Chloro-3-methylphenol	EPA 3550A	SIM	50	270	270	ND	232	218	86	81	23-108	6	
Acenaphthene	EPA 3550A	SIM	10	270	270	ND	227	207	84	77	43-117	9	
4-Nitrophenol	EPA 3550A	SIM	100	270	270	ND	250	230	93	85	22-113	8	
Pyrene	EPA 3550A	SIM	20	270	270	ND	249	239	92	89	24-143	4	

Approved By: DW Date: 11-13-97

DMS/090497a

08126SVM.AY3 - DMS 11/13/97

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client: MEC Analytical Systems, Inc.
Project: Homeport-Pearl Harbor
LCS Matrix: Sediment

Service Request: K9708126
Date Collected: NA
Date Received: NA
Date Extracted: 11/4/97
Date Analyzed: 11/7/97

Laboratory Control Sample Summary
Base Neutral/Acid Semivolatile Organic Compound

Sample Name: Lab Control Sample
Lab Code: KWG9703390-3
Test Notes:

Units: ug/kg
Basis: Dry

Analyte	Prep Method	Analysis Method	True Value	Result	Percent Recovery	CAS Percent Recovery Acceptance Limits	Result Notes
Phenol	EPA 3550A	SIM	250	199	80	32-96	
2-Chlorophenol	EPA 3550A	SIM	250	155	62	34-102	
4-Chloro-3-methylphenol	EPA 3550A	SIM	250	203	81	36-102	
Acenaphthene	EPA 3550A	SIM	250	238	95	44-112	
4-Nitrophenol	EPA 3550A	SIM	250	240	96	23-113	
Pyrene	EPA 3550A	SIM	250	252	101	44-126	

Approved By: DMA Date: 11-13-97

LCS/031497a

MEC ANALYTICAL SYSTEMS, INC.

(☒ Check One)
- ☐ 6060 Corte del Cedro • Carlsbad, CA 92009-1514 • (619) 931-9225, FAX 931-9251
- ☐ 2433 Impala Drive • Carlsbad, CA 92008 • (619) 931-8081, FAX 931-1580
- ☐ 98 Main Street, Suite #428 • Tiburon, CA 94920 • (415) 435-1847, FAX 435-0479

K9708124

CHAIN OF CUSTODY

00283

DATE 11/2/97 PAGE ____ OF ____

00059

PROJECT NAME/SURVEY/PROJECT NUMBER: Homeport - Pearl Harbor

PROJECT MANAGER: John Hardin

COMPANY: MEC

ADDRESS: See Above

PHONE/FAX:

ANALYSIS/TEST REQUESTED: To: CAS Kelso

SAMPLE I.D.	DATE	TIME	MATRIX	INITIALS	NUMBER & TYPE OF CONTAINERS	Chemistry Samples	Metals, 8081, 8270M TRPH, phenols, Organotins	TCLP-15 metals			PRESERVED HOW/ COMMENTS
Sta - 1-2-B	10/31/97		Marine	AM/JH	2		X	X			4°C (Sta-1-2-B)
Sta - 1-2-T	10/31/97		Sed	SL							(Sta-1-2-T)
~~Sta - 2 - B~~	~~10/31/97~~										
~~Sta - 2 - T~~	~~10/31/97~~										
3	10/31/97										
4	10/31/97										
5	10/31/97										
6	10/31/97										
7	10/31/97										
8											
9											
10											
Reference	11/1/97										

SHIPPING:

Shipping VIA: ____________ Airbill No. ____________

SPECIAL INSTRUCTIONS/COMMENTS: See Attached Documents or Lynda Huckestein

	RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY
Signature	Alan T. Ma[illegible]	[illegible]				
Firm	MEC	CAS				
Date/Time	11/2/97	11/3/97 930				

WHITE - return to originator • YELLOW - lab • PINK - retained by originator

Appendix E

Bioassay Report

Final Report
Sediment Characterization Study
CVN Homeporting Project
Pearl Harbor, Hawaii

Prepared for

MEC Analytical Systems
2433 Impala Drive
Carlsbad, California 92008

Prepared by

Ogden Environmental and Energy Services Co., Inc.
Bioassay Laboratory
5550 Morehouse Drive, Suite B
San Diego, California 92121
(619) 458-9044

December 1997
Project No. 3-1842-1000

SECTION 1 - INTRODUCTION

Toxicity testing was conducted on marine sediments collected in Pearl Harbor, Hawaii in support of the EIS impacts analysis for *Aircraft Carrier Homeporting Within Pacific Fleet's United States Assets*. Screening bioassays on bulk sediment were performed in accordance with standardized test protocols using the amphipod *Grandidierella japonica* and larvae of the bivalve *Crassostrea gigas.* The sediment testing program was coordinated by MEC Analytical Systems, Inc. (MEC) of Carlsbad, California. Sediments were collected by MEC personnel between October 30 and October 31, 1997 in Pearl Harbor, Hawaii. Reference sediment was collected on November 1, 1997 in Lanakai Beach, Oahu, Hawaii. Toxicity testing was performed between November 4 and November 14, 1997 at the Ogden Environmental and Energy Services Bioassay Laboratory in San Diego, California. All tests were conducted in accordance with the project sampling and analysis plan (Appendix A).

SECTION 2 - METHODS AND MATERIALS

2.1 SAMPLE COLLECTION AND SHIPPING

Sediment collection was initiated on October 30 and completed on November 1, 1997. Samples were received by MEC in Carlsbad, California by freight service on November 1 and 3, 1997. Appropriate chain-of-custody procedures were employed during collection and transport of the samples. Following receipt, the samples were homogenized and sieved by MEC and Ogden personnel in MEC's laboratory. Ogden transported the prepared samples in a cooler containing blue ice packs to Ogden's Bioassay Laboratory in San Diego. The sediment samples were received in good condition. Sample descriptions and identification information were recorded in the laboratory's sample receipt log. The samples were then placed in the laboratory's coldroom and maintained at 4°C until test initiation. The samples were identified as Reference, 1-2T (1T+2T), 1-2B (1B+2B), 3, 4, 5, 6, 7, 8, 9, and 10.

2.2 ORGANISM PROCUREMENT AND HANDLING

Amphipods

Test specimens of *Grandidierella japonica* were collected in Newport Bay, California by Mr. David Gutoff. Sediment cores were taken from the bay bottom and lightly sieved to remove the amphipods. The test specimens were then transported in clean, lined buckets containing sieved site sediment and seawater. The amphipods were identified and sorted to the species level by Mr. Gutoff prior to transport to the laboratory. Test animals were delivered to the lab on November 1, 1997.

Mr. Gutoff maintains a quality assurance log containing the date, weather conditions, physical conditions, and any specific comments pertaining to each collection event. Upon arrival at the laboratory, organism receipt information was recorded in a log book where physical parameters and animal condition were specified. The amphipods were acclimated to test conditions in order to promote and confirm animal health prior to test initiation. During the acclimation period, the animals were observed for any indications of significant mortality.

Bivalves

The test animal used was the Pacific oyster *Crassostrea gigas* procured from Mr. A.K. Siewers of Santa Cruz, California. The oyster brood stock were packed and shipped to arrive at the laboratory on November 7, 1997. In the laboratory, the date of organism receipt was recorded in a log book where arrival conditions were also noted. Oyster brood stock were acclimated to test conditions upon arrival and observed for mortality and abnormal behavior prior to test initiation.

2.3 BIOASSAY PROTOCOLS

Amphipod Bioassays

Amphipod tests were conducted according to the guidelines outlined in ASTM E 1367-92. Animals were exposed to test sediments for 10 days to determine any effect on amphipod survival. Toxicity test exposures were conducted under static-renewal conditions in 1-liter glass jars. Five replicates were analyzed for each test, reference, or control site. Two centimeters of test, reference, or control sediment were placed in each test chamber and covered with 950 milliliters (mL) of clean seawater. Test chambers were aerated through a 1-mL, cotton-plugged pipette at a rate of approximately one bubble per second. Test chambers were randomized and placed in an environmental chamber maintained at 15±1°C. The temperature of the testing chamber is continuously recorded and the data generated is maintained onsite.

Tests were initiated with the random addition of twenty amphipods to each of the five replicates per sediment type. Replicate test chambers for each test site, reference, and control were used for daily water quality measurements. Overlying water was renewed every other day in all test chambers. After 10 days, surviving test animals were gently removed by sieving the entire contents of each beaker through a Nitex® mesh screen. Organisms were counted and survival was determined based on visual observations.

Temperature, dissolved oxygen, pH, and salinity were monitored daily in a surrogate test chamber for each sediment site. All water quality measurements recorded during the 10-day amphipod exposure were in the range defined as acceptable by the test protocol. Subsamples of overlying water from each site were collected for ammonia analysis both at the beginning and end of the test period.

A reference toxicant test was conducted in conjunction with the site sediment tests to ensure that organisms were not impacted by stresses other than contamination in the test material (e.g., injury or disease, unfavorable physical or chemical conditions in the test containers, improper handling, or acclimation).

Bivalve Bioassays

Bivalve larvae tests were conducted according to the guidelines outlined in ASTM E 724-89. Survival and development of larvae were evaluated as endpoints to determine the effect of suspended-particulate material on bivalve larvae. Testing was conducted in 20-mL glass scintillation vials maintained at 20±1°C. Five replicates were tested for each concentration using 10 mL of test material per test chamber. Test chambers were arranged in randomized fashion. Fertilized eggs were introduced randomly into each test vessel from a well-mixed stock. Embryos were exposed to the test material for 67 hours. Development was not complete at the end of the 48-hour incubation period, therefore, the test protocol allows for the continuation of the test until complete development is observed in a surrogate control vial. The assays were terminated by adding 1 mL of 5 percent buffered formalin to each test vial.

Larval survival and development was determined by transferring a subsample of the preserved larvae onto a Sedgwick-Rafter® counting chamber, followed by visual observations made using a compound microscope. A total larvae count was made to assess survival. To determine normal development, all surviving larvae were scored as either normal or abnormal. Normal larvae were defined as those that had successfully reached the D-shaped prodissoconch I development stage. Photographs of normal and abnormal bivalve larvae are contained in the ASTM protocol.

Temperature, dissolved oxygen, pH, and salinity were monitored daily in a surrogate test chamber for the 100 percent test material from each site. All water quality measurements during the 67-hour exposure were in the range defined as acceptable by the test protocol. Subsamples of the lab control and the 100 percent test material from each site were collected for ammonia analysis both at the beginning and end of the test period.

A concurrent reference toxicant test using copper chloride was also conducted to ensure that the organisms were not being affected by stresses other than contamination in the test material (e.g., injury or disease, unfavorable physical or chemical conditions in the test chambers, improper handling, or insufficient acclimation).

2.4 QUALITY ASSURANCE PROCEDURES - TOXICITY TESTS

Test organisms used in the toxicity tests were collected in areas known to be generally free of pollutants or purchased from reputable culturist. Organisms were purchased from vendors who were screened by reputation, depth of knowledge concerning the organism of choice, and their ability to consistently deliver healthy test organisms. Upon receipt in the bioassay lab, test organisms were slowly acclimated to test conditions in environmentally controlled holding areas. Acclimation was performed in accordance with the test protocol associated with each test organism. Test organisms are evaluated on a performance basis for every test conducted in the laboratory.

The Bioassay Laboratory is certified by the State of Washington to conduct sediment testing (Washington is the only state that currently offers sediment testing certification). Ogden has consistently complied with all quality assurance regulations related to the Washington State certification program. The laboratory implements quality assurance procedures with application to all aspects of testing from source, handling, condition, receipt, and storage of samples and test organisms as well as calibration and maintenance of instruments and equipment used during testing. All data generated by the laboratory are monitored for completeness and accuracy at the end of each day and at the end of each individual test period to ensure generation of the highest quality data. Laboratory negative control and reference toxicant (i.e., positive control) testing are conducted concurrent to every sample assay and act to confirm test organism quality, sound laboratory conditions, and appropriateness of procedures.

2.5 STATISTICAL ANALYSES

Results were calculated using ToxCalc Comprehensive Toxicity Data Analysis and Database Software, Version 5.0. Statistical analyses for the amphipod assays were conducted by comparing the reference sediment with each test site. Probit Method was used to calculate the lethal effect concentration (LC_{50}) for the amphipod reference toxicant data.

Bivalve development data were analyzed by comparing the lab control with each test site concentration series. The LC_{50} and the median effect concentration (EC_{50}) were calculated for survival and normality data, respectively, for each of the bivalve sites. Probit Method was used to calculate the EC_{50} normality value for the bivalve reference toxicant data.

SECTION 3 - RESULTS

Test results are summarized in Table 3-1. The results for each test are outlined on Tables 3-2 through 3-13. Appendices B, C, and D contain water quality observations, test site statistical analyses, and reference toxicant data, respectively.

Table 3-1. Bioassay Results Summary
Homeporting Pearl Harbor
Grandidierella japonica* and *Crassostrea gigas

Test Site	**Solid Phase Analyses** Amphipod Average Percent Survival	**Suspended Particulate Phase Analyses** Bivalve Survival LC_{50} (percent elutriate)	Bivalve Normality EC_{50} (percent elutriate)
Control	98	NA	NA
Reference	94	>100	>100
1-2T	92	>100	>100
1-2B	89	67	65
3	90	77	73
4	92	77	62
5	93	>100	>100
6	97	81	71
7	92	70	70
8	97	>100	>100
9	95	>100	>100
10	95	>100	>100

NA = Not applicable

3.1 AMPHIPOD BIOASSAYS

Mean amphipod laboratory control survival was 98 percent. This value exceeds the protocol requirement of 90 percent and indicates that the test conditions were adequate and the test series was valid. The mean reference toxicant control survival was 100 percent. The LC_{50} value was determined to be 2.4 mg/L $CdCl_2$.

Reference Survival

The average amphipod reference survival was 94 percent. No minimum survival requirements are specified in the Green Book or the ASTM protocol for reference sediments. The high level of reference survival, however, provides verification that testing conditions were adequate, and meaningful comparisons can be made with test sediment replicates.

Site 1-2T Survival

Average survival for this site was 92 percent. Statistical analysis indicated no significant difference in survival between the reference and test site.

Site 1-2B Survival

Average survival for this site was 89 percent. Statistical analysis indicated no significant difference in survival between the reference and test site.

Site 3 Survival

Average survival for this site was 90 percent. Statistical analysis indicated no significant difference in survival between the reference and test site.

Site 4 Survival

Average survival for this site was 92 percent. Statistical analysis indicated no significant difference in survival between the reference and test site.

Site 5 Survival

Average survival for this site was 93 percent. Statistical analysis indicated no significant difference in survival between the reference and test site.

Site 6 Survival

Average survival for this site was 97 percent. Statistical analysis indicated no significant difference in survival between the reference and test site.

Site 7 Survival

Average survival for this site was 92 percent. Statistical analysis indicated no significant difference in survival between the reference and test site.

Site 8 Survival

Average survival for this site was 97 percent. Statistical analysis indicated no significant difference in survival between the reference and test site.

Site 9 Survival

Average survival for this site was 95 percent. Statistical analysis indicated no significant difference in survival between the reference and test site.

Site 10 Survival

Average survival for this site was 95 percent. Statistical analysis indicated no significant difference in survival between the reference and test site.

3.2 BIVALVE LARVAE BIOASSAYS

The average number of larvae contained in the five laboratory control replicates at test termination was determined to be 12.2 bivalve larvae per mL. This average was used as a baseline to determine if statistically significant reductions in survival occurred in the test treatments. A single group of control replicates was tested in association with the test sites. Average laboratory control normality was 93 percent. This average was calculated by dividing the total number of normal larvae by the total larvae counted. This value exceeds the protocol requirement of 70 percent and indicates that the test conditions were adequate and the test series was valid. The reference toxicant exhibited an average control normality of 89 percent. The EC_{50} value was 13.9 µg/L $CuCl_2$ for normality data.

Reference Survival and Normality

Statistical analyses indicated no significant difference in either survival or normality between the lab control and any elutriate treatment. The LC_{50}/EC_{50} values for both survival and normality were >100 percent elutriate.

Site 1-2T Survival and Normality

Statistical analyses indicated no significant difference in either survival or normality between the lab control and any elutriate treatment. The LC_{50}/EC_{50} values for both survival and normality were >100 percent elutriate.

Site 1-2B Survival and Normality

Statistical analyses indicated a significant difference in survival between the lab control and the 50 and 100 percent elutriate treatments. Statistical analyses indicated a

significant difference in normality between the lab control and the 50 and 100 percent elutriate treatments. The LC_{50} for survival was 67 percent elutriate and the EC_{50} normality value was 65 percent elutriate.

Site 3 Survival and Normality

Statistical analyses indicated a significant difference in survival between the lab control and the 10, 50, and 100 percent elutriate treatments. Further analyses indicated a significant difference in normality between the lab control and the 50 and 100 percent elutriate treatments. The LC_{50} for survival was 77 percent elutriate and the EC_{50} normality value was 73 percent elutriate.

Site 4 Survival and Normality

Statistical analyses indicated a significant difference in survival between the lab control and the 1, 10, 50, and 100 percent elutriate treatments. Analyses of normality data indicated a significant difference between the lab control and the 50 and 100 percent elutriate treatments. The LC_{50} survival value was 77 percent elutriate and the EC_{50} normality value was 62 percent elutriate.

Site 5 Survival and Normality

Statistical analyses indicated no significant difference in survival between the lab control and any elutriate treatment. Statistical analyses indicated a significant difference in normality between the lab control and the 50 and 100 percent elutriate treatments. The LC_{50}/EC_{50} values for both survival and normality were >100 percent elutriate.

Site 6 Survival and Normality

Statistical analyses indicated a significant difference in survival between the lab control and the 100 percent elutriate treatment. Statistical analyses indicated a significant difference in normality between the lab control and the 50 and 100 percent elutriate

treatments. The LC_{50} survival value was 81 percent elutriate and the EC_{50} normality value was 71 percent elutriate.

Site 7 Survival and Normality

Statistical analyses indicated a significant difference in survival between the lab control and the 10, 50, and 100 percent elutriate treatments. Statistical analyses indicated a significant difference in normality between the lab control and the 10, 50, and 100 percent elutriate treatments. The LC_{50} survival value was 70 percent elutriate and the EC_{50} normality value was 70 percent elutriate.

Site 8 Survival and Normality

Statistical analyses indicated no significant difference in survival between the lab control and any elutriate treatment. A significant difference in normality was identified between the lab control and the 1, 10, 50, and 100 percent elutriate treatments. The LC_{50}/EC_{50} values for both survival and normality were >100 percent elutriate.

Site 9 Survival and Normality

Statistical analyses indicated a significant difference in survival between the lab control and the 100 percent elutriate treatment. Analyses of normality data indicated a significant difference between the lab control and the 50 and 100 percent elutriate treatments. The LC_{50}/EC_{50} values for both survival and normality were >100 percent elutriate.

Site 10 Survival and Normality

Statistical analyses indicated no significant difference in either survival or normality between the lab control and any elutriate treatment. The LC_{50}/EC_{50} values for both survival and normality were >100 percent elutriate.

Table 3-2. 10-Day Solid Phase Bioassay with *Grandidierella japonica*

Test Site	Rep	Number Alive	Number Dead	Percent Survival	Average Percent Survival
Control	A	18	2	90	
	B	20	0	100	
	C	20	0	100	
	D	20	0	100	
	E	20	0	100	98
Reference	A	18	2	90	
	B	17	3	85	
	C	19	1	95	
	D	20	0	100	
	E	20	0	100	94
1-2T	A	18	2	90	
	B	18	2	90	
	C	17	3	85	
	D	19	1	95	
	E	20	0	100	92
1-2B	A	18	2	90	
	B	17	3	85	
	C	18	2	90	
	D	19	1	95	
	E	17	3	85	89
3	A	19	1	95	
	B	18	2	90	
	C	18	2	90	
	D	17	3	85	
	E	18	2	90	90
4	A	16	4	80	
	B	19	1	95	
	C	19	1	95	
	D	18	2	90	
	E	20	0	100	92

Table 3-2 (Continued). 10-Day Solid Phase Bioassay with *Grandidierella japonica*

Test Site	Rep	Number Alive	Number Dead	Percent Survival	Average Percent Survival
5	A	19	1	95	
	B	18	2	90	
	C	19	1	95	
	D	18	2	90	
	E	19	1	95	93
6	A	20	0	100	
	B	19	1	95	
	C	20	0	100	
	D	19	1	95	
	E	19	1	95	97
7	A	15	5	75	
	B	19	1	95	
	C	19	1	95	
	D	20	0	100	
	E	19	1	95	92
8	A	20	0	100	
	B	20	0	100	
	C	19	1	95	
	D	18	2	90	
	E	20	0	100	97
9	A	19	1	95	
	B	18	2	90	
	C	19	1	95	
	D	19	1	95	
	E	20	0	100	95
10	A	19	1	95	
	B	20	0	100	
	C	18	2	90	
	D	20	0	100	
	E	18	2	90	95

Table 3-3. Bivalve Larvae Development Results Summary - Reference

Elutriate Concentration (percent)	Rep	Total Larvae	Number Normal Larvae Counted	Percent Normal	Average Percent Normal	Average Percent Survival
Laboratory Control	A	116	106	91		
	B	126	119	94		
	C	109	107	98		
	D	132	120	91		
	E	125	113	90	93	100
1	A	107	96	90		
	B	120	110	92		
	C	155	133	86		
	D	99	92	93		
	E	118	111	94	91	93
10	A	78	70	90		
	B	88	84	95		
	C	93	81	87		
	D	83	79	95		
	E	90	84	93	92	71
50	A	102	98	96		
	B	69	63	91		
	C	135	123	91		
	D	146	108	74		
	E	94	88	94	89	84
100	A	104	101	97		
	B	118	111	94		
	C	133	110	83		
	D	142	126	89		
	E	147	129	88	90	97

EC_{50} normality value is >100 percent elutriate.

LC_{50} survival value is >100 percent elutriate.

Table 3-4. Bivalve Larvae Development Results Summary - Site 1-2T

Elutriate Concentration (percent)	Rep	Total Larvae	Number Normal Larvae Counted	Percent Normal	Average Percent Normal	Average Percent Survival
Laboratory Control	A	116	106	91		
	B	126	119	94		
	C	109	107	98		
	D	132	120	91		
	E	125	113	90	93	100
1	A	113	108	96		
	B	113	104	92		
	C	144	134	93		
	D	114	101	89		
	E	103	102	99	94	93
10	A	107	104	97		
	B	124	115	93		
	C	136	125	92		
	D	109	104	95		
	E	140	129	92	94	96
50	A	188	179	95		
	B	88	80	91		
	C	121	113	93		
	D	151	141	93		
	E	179	167	93	93	94
100	A	132	120	91		
	B	116	106	91		
	C	156	136	87		
	D	103	95	92		
	E	118	101	86	89	95

EC_{50} normality value is >100 percent elutriate.

LC_{50} survival value is >100 percent elutriate.

Table 3-5. Bivalve Larvae Development Results Summary - Site 1-2B

Elutriate Concentration (percent)	Rep	Total Larvae	Number Normal Larvae Counted	Percent Normal	Average Percent Normal	Average Percent Survival
Laboratory Control	A	116	106	91		
	B	126	119	94		
	C	109	107	98		
	D	132	120	91		
	E	125	113	90	93	100
1	A	94	91	97		
	B	108	101	94		
	C	95	92	97		
	D	106	92	87		
	E	76	70	92	93	79
10	A	73	67	92		
	B	151	138	91		
	C	146	137	94		
	D	120	109	91		
	E	105	95	90	92	89
50	A	82	33	40		
	B	69	46	67		
	C	95	76	80		
	D	65	41	63		
	E	107	76	71	64*	69*
100	A	19	1	5		
	B	26	8	31		
	C	14	2	14		
	D	13	2	15		
	E	22	4	18	17*	15*

EC_{50} normality value is 65 percent elutriate.

LC_{50} survival value is 67 percent elutriate.

* Statistically significant ($p \leq 0.05$)

Table 3-6. Bivalve Larvae Development Results Summary - Site 3

Elutriate Concentration (percent)	Rep	Total Larvae	Number Normal Larvae Counted	Percent Normal	Average Percent Normal	Average Percent Survival
Laboratory Control	A	116	106	91		
	B	126	119	94		
	C	109	107	98		
	D	132	120	91		
	E	125	113	90	93	100
1	A	154	121	79		
	B	123	98	80		
	C	226	193	85		
	D	104	91	88		
	E	110	92	84	83	95
10	A	110	92	84		
	B	206	176	85		
	C	114	103	90		
	D	114	106	93		
	E	73	62	85	87	88*
50	A	104	88	85		
	B	112	86	77		
	C	103	79	77		
	D	85	61	72		
	E	107	77	72	76*	84*
100	A	31	9	29		
	B	28	9	32		
	C	14	0	0		
	D	30	2	7		
	E	23	2	9	15*	21*

EC_{50} normality value is 73 percent elutriate.

LC_{50} survival value is 77 percent elutriate.

* Statistically significant ($p \leq 0.05$)

Table 3-7. Bivalve Larvae Development Results Summary - Site 4

Elutriate Concentration (percent)	Rep.	Total Larvae	Number Normal Larvae Counted	Percent Normal	Average Percent Normal	Average Percent Survival
Laboratory Control	A	116	106	91		
	B	126	119	94		
	C	109	107	98		
	D	132	120	91		
	E	125	113	90	93	100
1	A	147	123	84		
	B	78	72	92		
	C	77	61	79		
	D	88	78	89		
	E	80	68	85	86	73*
10	A	83	70	84		
	B	91	82	90		
	C	102	88	86		
	D	96	80	83		
	E	116	94	81	85	80*
50	A	140	95	68		
	B	74	39	53		
	C	81	48	59		
	D	88	55	63		
	E	69	34	49	58*	71*
100	A	40	4	10		
	B	39	22	56		
	C	46	0	0		
	D	52	8	15		
	E	43	1	2	17*	36*

EC_{50} normality value is 62 percent elutriate.

LC_{50} survival value is 77 percent elutriate.

* Statistically significant ($p \leq 0.05$)

Table 3-8. Bivalve Larvae Development Results Summary - Site 5

Elutriate Concentration (percent)	Rep	Total Larvae	Number Normal Larvae Counted	Percent Normal	Average Percent Normal	Average Percent Survival
Laboratory Control	A	116	106	91		
	B	126	119	94		
	C	109	107	98		
	D	132	120	91		
	E	125	113	90	93	100
1	A	149	131	88		
	B	121	99	82		
	C	122	98	80		
	D	97	76	78		
	E	85	76	89	84	90
10	A	116	108	93		
	B	65	63	97		
	C	131	114	87		
	D	96	87	91		
	E	65	58	89	91	76
50	A	75	62	83		
	B	91	80	88		
	C	82	66	80		
	D	99	93	94		
	E	84	73	87	86*	71
100	A	101	84	83		
	B	141	130	92		
	C	105	87	83		
	D	74	60	81		
	E	131	108	82	84*	86

EC_{50} normality value is >100 percent elutriate.

LC_{50} survival value is >100 percent elutriate.

* Statistically significant ($p \leq 0.05$)

Table 3-9. Bivalve Larvae Development Results Summary - Site 6

Elutriate Concentration (percent)	Rep	Total Larvae	Number Normal Larvae Counted	Percent Normal	Average Percent Normal	Average Percent Survival
Laboratory Control	A	116	106	91		
	B	126	119	94		
	C	109	107	98		
	D	132	120	91		
	E	125	113	90	93	100
1	A	131	106	81		
	B	96	87	91		
	C	126	110	87		
	D	160	138	86		
	E	109	86	79	85	94
10	A	116	100	86		
	B	100	92	92		
	C	134	121	90		
	D	82	68	83		
	E	93	78	84	87	84
50	A	129	110	85		
	B	108	82	76		
	C	121	94	78		
	D	93	75	81		
	E	150	128	85	81*	93
100	A	30	2	7		
	B	29	7	24		
	C	34	1	3		
	D	63	8	13		
	E	54	2	4	10*	35*

EC_{50} normality value is 71 percent elutriate.

LC_{50} survival value is 81 percent elutriate.

* Statistically significant ($p \leq 0.05$)

Table 3-10. Bivalve Larvae Development Results Summary - Site 7

Elutriate Concentration (percent)	Rep	Total Larvae	Number Normal Larvae Counted	Percent Normal	Average Percent Normal	Average Percent Survival
Laboratory Control	A	116	106	91		
	B	126	119	94		
	C	109	107	98		
	D	132	120	91		
	E	125	113	90	93	100
1	A	117	101	86		
	B	137	113	82		
	C	106	89	84		
	D	116	99	85		
	E	73	62	85	85	88
10	A	104	91	88		
	B	94	83	88		
	C	59	50	85		
	D	66	49	74		
	E	90	75	83	84*	68*
50	A	83	55	66		
	B	71	54	76		
	C	114	97	85		
	D	65	49	75		
	E	74	60	81	77*	67*
100	A	60	0	0		
	B	31	4	13		
	C	44	3	7		
	D	71	10	14		
	E	32	9	28	12*	39*

EC_{50} normality value is 70 percent elutriate.

LC_{50} survival value is 70 percent elutriate.

* Statistically significant ($p \leq 0.05$)

Table 3-11. Bivalve Larvae Development Results Summary - Site 8

Elutriate Concentration (percent)	Rep	Total Larvae	Number Normal Larvae Counted	Percent Normal	Average Percent Normal	Average Percent Survival
Laboratory Control	A	116	106	91		
	B	126	119	94		
	C	109	107	98		
	D	132	120	91		
	E	125	113	90	93	100
1	A	97	77	79		
	B	105	93	89		
	C	36	25	69		
	D	102	77	75		
	E	102	93	91	81*	73
10	A	80	55	69		
	B	107	83	78		
	C	113	88	78		
	D	115	102	89		
	E	113	87	77	78*	87
50	A	81	56	69		
	B	90	75	83		
	C	113	97	86		
	D	180	159	88		
	E	158	130	82	82*	87
100	A	97	74	76		
	B	129	86	67		
	C	94	74	79		
	D	122	98	80		
	E	88	64	73	75*	86

EC_{50} normality value is >100 percent elutriate.

LC_{50} survival value is >100 percent elutriate.

* Statistically significant ($p \leq 0.05$)

Table 3-12. Bivalve Larvae Development Results Summary - Site 9

Elutriate Concentration (percent)	Rep	Total Larvae	Number Normal Larvae Counted	Percent Normal	Average Percent Normal	Average Percent Survival
Laboratory Control	A	116	106	91		
	B	126	119	94		
	C	109	107	98		
	D	132	120	91		
	E	125	113	90	93	100
1	A	116	99	85		
	B	131	120	92		
	C	110	98	89		
	D	140	130	93		
	E	144	133	92	90	97
10	A	106	94	89		
	B	99	88	89		
	C	126	106	84		
	D	76	64	84		
	E	145	140	97	88	86
50	A	97	70	72		
	B	135	117	87		
	C	133	124	93		
	D	114	99	87		
	E	93	81	87	85*	90
100	A	74	58	78		
	B	35	27	77		
	C	111	86	77		
	D	111	94	85		
	E	79	66	84	80*	67*

EC_{50} normality value is >100 percent elutriate.

LC_{50} survival value is >100 percent elutriate.

* Statistically significant ($p \leq 0.05$)

Table 3-13. Bivalve Larvae Development Results Summary - Site 10

Elutriate Concentration (percent)	Rep	Total Larvae	Number Normal Larvae Counted	Percent Normal	Average Percent Normal	Average Percent Survival
Laboratory Control	A	116	106	91		
	B	126	119	94		
	C	109	107	98		
	D	132	120	91		
	E	125	113	90	93	100
1	A	131	114	87		
	B	79	68	86		
	C	98	87	89		
	D	127	114	90		
	E	88	81	92	89	84
10	A	107	98	92		
	B	93	83	89		
	C	127	118	93		
	D	82	71	87		
	E	99	91	92	90	83
50	A	96	90	94		
	B	67	65	97		
	C	71	66	93		
	D	82	75	91		
	E	121	109	90	93	72
100	A	109	100	92		
	B	44	39	89		
	C	126	104	83		
	D	171	161	94		
	E	102	96	94	90	82

EC_{50} normality value is >100 percent elutriate.

LC_{50} survival value is >100 percent elutriate.

SECTION 4 - REFERENCES

American Society for Testing and Materials (ASTM), 1993. Conducting 10-day Static Sediment Toxicity Tests with Marine and Estuarine Amphipods. ASTM Designation E 1367-92.

American Society for Testing and Materials (ASTM), 1993. Conducting Static Acute Toxicity Test Starting with Embryos of Four Species of Saltwater Bivalve Molluscs. ASTM Designation E 724-89.

Tidepool Scientific Software, 1992-1994. ToxCalc Comprehensive Toxicity Data Analysis and Database Software, Version 5.0.

APPENDIX A

SAMPLING AND ANALYSIS PLAN

SAMPLING AND ANALYSIS PLAN PEARL HARBOR SEDIMENTS

FOR

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR AIRCRAFT CARRIER HOMEPORTING WITHIN PACIFIC FLEET'S UNITED STATES ASSETS

Prepared by

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Prepared for

Science Applications International Corporation

1.1 INTRODUCTION

1.1.1 OBJECTIVES OF STUDY

This project supports impacts analysis associated with an environmental impact statement (EIS) and is not intended to provide data appropriate for an ocean disposal permit application.

The *EIS for Aircraft Carrier Homeporting Within Pacific Fleet's United States Assets* will evaluate impacts of homeporting a NIMITZ-class nuclear aircraft carrier (CVN) at pier B2/3 in the Pearl Harbor Naval Shipyard (PHNSY). In order to accommodate the CVN, the Pearl Harbor Inner Channel, turning basin, and the berth (the area adjacent to pier B2/3) will require dredging to a design depth of 50' below mean lower low water (MLLW). The impacts of disposing dredge spoils either at the South Oahu Ocean Dredged Material Disposal Site (ODMDS) or at a near-shore or upland disposal site will depend on the chemical nature of the dredged sediment, based on standardized testing procedures.

Therefore, in support of the EIS impacts analysis, the objective of this sampling effort is to obtain screening level chemistry and bioassay results for bulk sediment at the dredge sites, i.e., the berth, turning basin, and inner channel. The level of detail will be appropriate to assessing the general volume of material likely to be suitable for ocean disposal and the quantity for which alternative disposal sites are expected to be necessary.

1.1.2 PROJECT TEAM AND RESPONSIBILITIES

Project planning and coordination will be performed by Amy Sheridan at Belt Collins Hawaii. This task includes logistics arrangements with Pearl Harbor Port Operations and the Signal Tower, preparation of this Sampling and Analysis Plan (SAP), and writing up results for the EIS.

Field sample collection will be managed by David Robinson of MEC Analytical Systems, Inc. of Carlsbad, California; the field manager will be John Hardin. Barge support will be furnished by Sea Engineering Inc (Waimanalo, Hawaii), supervisor Ted Durland. Additional technical support will be provided by John Evans of SAIC.

Laboratory preparation and analysis will be performed by Ogden Environmental Services. Ogden will manage its own lab QA/QC and will prepare the **laboratory report** for MEC.

1.1.3 SAMPLE SITES

1.1.3.1 Sample Sites

The sampling sites consist of areas to be transitted or occupied by a NIMITZ-class CVN, i.e.

- berths B2 and B3 in the PHNSY

(the turning basin between berth and Ford Island

(the inner channel from Bishop Point to Hospital Point

Recent (1995-1996) bathymetric surveys indicate existing depths of about 43 to 50 feet below MLLW in these locations. The project dredge depth would be 50 feet below MLLW; therefore, samples will be obtained to a depth of approximately 52' below MLLW.

A minimum of 10 cores will be obtained and a total of 10 composite samples will be analyzed. Compositing decisions will be finalized at the time of sampling, after visual inspection of the cores. It is anticipated that the 10 composited samples will consist of the following:

1□Composite of upper halves (or layers, if such exist) of two cores obtained adjacent to B2/3

2□Composite of lower halves (or layers) of two cores obtained adjacent to B2/3

3□Vertical composite of core obtained ±300 feet off of B2/3

4□- 7. Vertical composite of each of four turning basin samples (i.e., excluding central core). Alternatively, if obvious layering is present, samples will consist of composited upper halves and lower halves of two sets of two cores.

8.- 10. Vertical composite of each of three inner channel samples

If substantially heterogeneous sediments are encountered in the turning basin, the fifth core will be submitted as an additional sample, and two of the inner channel samples will be composited for a total of 10 samples.

1.1.3.2 Existing Condition of Sites

Pearl Harbor channel sediment is generally very fine and is routinely disturbed and resuspended by passing ships. The sediment/water interface tends to be gradual in most locations. The result is a highly nephelous surface sediment layer of indeterminate thickness, with more consolidated sediment underneath. Surface samples have been obtained from various harbor locations over the last 10 years. In general, analysis has shown the presence of heavy metals, organotin, petroleum hydrocarbons, and PAHs in various concentrations.

Berths B2/3 have been used to dock various naval vessels since World War II. It is not known when these particular berths were last dredged. Sediments are expected to be well consolidated. Although no sediment samples have been obtained or analyzed from immediately offshore of the berth, sampling results from other Pearl Harbor piers suggest that sediments may contain heavy metals, organotin, or petroleum products commonly associated with ship servicing and maintenance.

The turning basin is an area transited by most vessels entering or leaving the shipyard, the Naval Station, Ford Island, and the FISC piers. Sediment in this area is expected to be well-mixed and poorly consolidated. Analysis of nearby sediment surfaces (Operations Division, 1990) indicate the presence of heavy metals and minor petroleum products, but no pesticides, PAHs (polynuclear aromatic hydrocarbons), or phthalates.

The inner channel is transited by all vessels entering and leaving all three lochs of Pearl Harbor. Sediment in this area is expected to be well-mixed and poorly consolidated. Previous samples obtained from this area contained heavy metals (notably silver) and PCBs (Grovhoug, 1992).

1.2 FIELD SAMPLING PROCEDURES

A total of 10 samples will be analyzed, together with one reference sample and one control sample.

1.2.1 SAMPLE LOCATIONS

A minimum of 10 cores will be obtained from the site (Figure 1). Additional cores may be required to provide sufficient volume for analysis.

- **B2/3:** At least 3 cores will be obtained, one each from B2 and B3 within 50 feet of the pier, and a third midway between the first two but 300 feet from the pier (see Figure X).
- **Turning basin:** At least 5 cores will be obtained from the roughly rectangular turning basin, one from the center of each quadrant and one from the center of the basin.
- **Inner channel:** Three cores will be obtained from the approximate center of the inner channel. One will be obtained opposite Bishop Point, one approximately 1000 feet north of Waipio Point, and one at the southern end of Ford Island
- **Reference sample:** The sample will be carbonate sand obtained offshore of Lanikai beach, on the windward side of Oahu.
- **Control sample:** The matrix in which laboratory animals are received will be used as the control sample.

Approximate latitudes and longitudes for each sample are given below. However, because the purpose of the study is general characterization of relatively large areas, pre-survey location accuracy is less important than accurate documentation of actual sample locations. It is anticipated that the positional accuracy of core samples using GPS with US Coast Guard differential signal will be within 3 to 5 meters of the intended locations. Position averaging will be used during the period at each station to obtain the most accurate fix obtainable with the equipment.

1:	N21°21'30", W157°57'35"	6.	N21°21'38", W157°57'28"
2:	N21°21'48", W157°57'25"	7:	N21°21'45", W157°57'15"
3:	N21°21'35", W157°57'25"	8:	N21°21'15", W157°58'00"
4:	N21°21'40", W157°57'48"	9:	N21°20'48", W157°58'30"
5:	N21°22'10", W157°57'25"	10:	N21°20'00", W157°58'35"

If the vibracore encounters refusal (e.g., rubble piles, coral), the location will be moved to one side. If refusal occurs for three attempts at one location, the sampling team will leave that station and continue on to sample other locations. The refused location will be revisited after all other stations are completed, for sampling to the depth achievable.

1.2.2 FIELD OPERATIONS

Samples will be obtained using a vibracore mounted on a barge. The barge will be stabilized at the coring stations by three- or four-point moorings, depending on current and wind conditions at open water station near the pier, two lines may be tied off to the pier, with anchors set bayward of the barge. The barge will mobilize out of Rainbow Marina within Pearl Harbor and Aiea Bay.

Field Sampling Schedule

Sampling activities are planned for September 5th through 7th, including mobilization and demobilization. Due to the high frequency of marine traffic in the Pearl Harbor main channel and adjoining areas, contact will be maintained via cellular phone with Chief Christopherson of the Pearl Harbor Port Operations and Signal Tower for ship traffic updates. Additionally, marine traffic will be monitored on marine radio channel(s) 16 and 69 for any additional news or emergencies. The barge will fly day markers for vessels with restricted maneuverability, as coordinated with Port Operations.

Vessel(s)

Field sampling will be conducted from a non-powered stationary platform (e.g., approximately 20 x 20 ft. barge). A Boston Whaler (approximately 15 feet) will be used to position and moor the barge. Additionally, the Whaler will be used to transport sample team members, equipment and sample cores between the barge and shore. The sampling platform and Whaler will be provided by Sea Engineering, Inc. (SEI). The barge will be outfitted with a 15-foot-high A-frame/crane, which will be used to deploy and recover the vibracore. Additionally, a DGPS (Global Positioning Satellite with differential correction) receiver will be used to document station locations. The barge is large enough to accommodate the vibracore and related equipment. The 15' A-frame is within the Ford Island Bridge 30' overhead clearance of the fixed span.

Navigation and Positioning

Target stations and depths have been selected for the sediment characterization study. Sample locations are discussed in detail in section 1.2.1. Briefly, the stations are located in three general areas including: pier-side (3 ea.), turning basin (5 ea.) and inner channel (3 ea.).

All open-harbor (i.e., turning basin and inner channel) stations will be accessed by transporting the barge to the approximate station location. The barge will be secured by making a four-point mooring using the Whaler to deploy the requisite anchors/mooring equipment. Once the barge has been secured, differential GPS positions will be continuously logged (e.g., every half-hour).

Pier-side stations will be accessed by maneuvering the barge into position using the Whaler and securing it to the pier with mooring lines. Additional lines may be required on the offshore side of the barge if additional stability is required. These additional mooring lines will be deployed in the same fashion as the four-point mooring discussed above.

1.2.3 SAMPLE COLLECTIONS

Sample Collection Procedures

The samples will be collected using a vibratory coring system (vibracorer) provided by MEC Analytical Systems of Carlsbad, CA. The Rossfelder® P–5 vibracorer was selected for the project due to its success collecting unconsolidated and consolidated sediments in marine environments. The vibracorer is an air-powered sediment sampling system featuring a pneumatic impacting bin vibrator head, which drives an aluminum or steel core tube containing a cellulose-acetate-butryate (CAB) liner into the sediment. Core liners will be cut to accommodate the required project depth plus 1-2 foot. The core liners are approximately 3.5 inch inside diameter.

The deployment and retrieval of the coretube and vibracorer will be conducted from the barge in the following manner. Bottom depth will be verified at each station, once the barge has been positioned and the appropriate sample depth will be calculated and logged. The coretube and vibracorer will be prepared and attached while laid out on the barge. The coretube will be measured so that the correct length of sample will be taken. The core lengths will vary and are dependent upon the bathymetry, intended project depth, and sample location. The Vibracorer will then be attached to a cable deployed from the barge crane/A-frame and the whole assembly lifted into a vertical orientation and deployed over the side of the barge. A measuring tape will be attached to the vibracorer head to indicate the coring depth. The coretube and vibracorer assembly will then be lowered to the benthic surface.

When the coretube nose has reached the sediment surface, the distance on the measuring tape will be note on the core log form, with the initial position fix. The vibracorer will be actuated and the driven to the intended depth. The distance on the measuring tape will again be logged. Additionally, the time, date, core length and any other pertinent information will be recorded in the logbook. Once the core has been taken, the coretube/vibracorer assembly will be recovered aboard the barge. The coretube will be removed from the vibracorer head. The core liner will be removed from the outer coretube and endcaps installed to prevent leakage of core sediments. The core will be kept in a vertical orientation and allowed to sit until disturbed surface sediments have settled. Prior to relocating the barge, the latitude and longitude fix will be annotated to reflect any changes resulting from position averaging.

Sample Collection and Handling Procedures

As samples are collected, logs and field notes of all core samples will be maintained and correlated to the sampling location map. Included in this log will be the following:

- Elevation of each boring station sampled as measured from mean lower low water (MLLW). This will be accomplished using a lead line to determine depth at the sampling location, referenced to an on-site tide gauge set to MLLW or other local tidal reference.
- Date and time of collection of each sediment core sample.
- Names of field supervisor and person(s) collecting and logging in the sample.
- Weather conditions.
- The sample station number as provided by Belt Collins.
- Length and depth intervals of each core section and recovery for each sediment sample as measured from MLLW.
- Qualitative notation of apparent resistance of sediment column to coring.
- Any deviation to the approved sampling plan.

Core Extrusion and Logging.

The sample handling area will be decontaminated and clean aluminum foil and/or polyethylene sheets will be placed under the core to prevent contamination during handling. The core samples will be extruded into stainless steel tubs or bowls. Using an aluminum foil-covered tool if resistance is too great may provide assistance. In the event the sample cannot be extruded intact, the CAB core tube will be cut open longitudinally using a saw or utility knife. Pre-cleaned stainless steel utensils will be used to manipulate the sediment. Any deviations to the procedures will be documented in the field notebook.

The following information will be recorded in the field notebook and sediment coring log:

- Date, time, and name of person logging sample.
- Station and sample identification;
- Depth of water at location.
- Sediment sample depth.
- Gross physical characterization of the sediment.
- Approximate grain size distribution.
- Density/consistency.
- Plasticity.
- Color
- Moisture content.
- Biological structures (e.g., shells, tubes, macorphytes, and bioturbation).
- Presence of debris (e.g., wood chips, wood fibers, other human industrial artifacts).
- Presence of oil sheen.
- Odor (e.g., hydrogen sulfide, petroleum hydrocarbons).

Sample Compositing.

Sediment core samples will only be composited if it is determined that multiple strata have been encountered during the coring process. If this is the case, similar strata will be composited between multiple cores. Only cores collected from similar areas will be composited (e.g., only turning basin sediments will be composited together, etc.). Compositing will be performed after

the sediment has been described. The core sections will be extruded into decontaminated stainless bowls and mixed thoroughly using decontaminated stainless steel utensils. The samples will be aliquoted for chemical characterization, physical properties and bioassay testing.

After compositing, samples aliquoted for chemical characterization and physical properties will be placed in pre-cleaned containers provided by Ogden laboratories. Samples for bioassay testing will be placed in polyethylene (or similar) bags, oxygen removed, and placed in buckets and sealed. Samples for physical, chemical and bioassay will be containerized and preserved in accordance with EPA/USACE "Green Book" methods. One noted exception is that all samples will be preserved at approximately 4° C using wet ice and held in darkness. Each container will be clearly labeled with the project name, sample/composite identification, type of analysis to be performed, date and time sampled and initials of person(s) preparing the sample, and referenced by entry into the logbook. Additionally, all samples will be documented on a Chain of Custody (COC). A copy of the COC(s) will be enclosed in the cooler with the samples and sent to the laboratory for analysis. The field team will retain additional copies of the COC(s). Any residual sediment will be disposed of in the harbor as close to the point of collection as possible.

Decontamination.

All sampling core liners will be thoroughly cleaned prior to use according to the following procedure:

- Wash with brush and Alconox ™ soap.
- Rinse with potable water.
- Rinse with distilled or deionized water.

The core liners will be kept clean by taping end caps over the exposed ends of the tubes. Additional decontamination will be conducted on all compositing and sampling equipment, (e.g., mixing bowls compositing utensils, scoops, etc.). Sampling equipment will be cleaned according to the following procedure:

- Wash with brush and Alconox ™ soap.
- Rinse with potable water.
- Rinse with distilled or deionized water.
- Rinse with pesticide grade Methanol.
- Rinse with pesticide Hexane.

Sample equipment may be kept clean by wrapping in aluminum foil prior to use. All core sediment handling will be done using nitrile or equivalent gloves to prevent contamination.

Sample Transport and Chain-of-Custody.

At the end of each day the sediment samples will be packed into coolers for delivery to the laboratories and preserved at approximately 4° C using wet ice. The samples will be shipped at the conclusion of field sampling. Specific procedures are as follows:

- Sample bottles will be clearly labeled with sample station and number, depth, date and time of collection, type of analysis, and sampler's initials.
- Samples will be packaged and shipped in accordance with USDOT regulations. Sample bottles will be placed coolers with blue ice or wet ice and packed with either bubble wrap or vermiculite to prevent breakage.
- The coolers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the cooler and recipient's office name and address) to enable positive identification.
- A sealed envelope (e.g., Ziploc® bag) containing chain-of-custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
- Signed and dated chain-of-custody seals will be placed on all coolers prior to shipping.
- Coolers will be taped securely with duct tape, strapping tape or other to prevent them from breaking open during shipment.

1.2.4 FIELD QA/QC PROCEDURES

Field sampling. The field sampling quality assurance objectives will be met by MEC Analytical Systems Inc. Internal MEC Standard Operating Procedures (SOPs) define vibracore sampling, sample preservation and shipping, and Chain of Custody systems. Sample logs are completed in ink. A photographic record of each core will be compiled.

1.3 DATA ANALYSIS AND REPORTING

The samples will be analyzed by Ogden Environmental and Energy Services San Diego, California and Columbia Analytical Services in Kelso, Washington.

1.3.1 ANALYSES

Physical and chemical analyses. Test and reference sediments will be analyzed for the standard suite of Tier II parameters required by the Green Book: 15 priority pollutant metals, PCBs, pesticides, phenols, TRPH (total recoverable petroleum hydrocarbons), PAHs, organic tin, total sulfides, and ammonia.

Bioassays. Two bioassay screening tests will be performed for each of the ten composite core samples and one reference sediment sample. A solid phase test using amphipods and a liquid/suspended phase test using bivalve larva will be conducted. Potential sediment toxicity will be determined by monitoring species survival.

1.3.1.1 Procedures: Physical and Chemical Analyses

Physical properties. Tests to characterize the physical properties of the sediments will be performed to predict the behavior of sediments after disposal and to compare reference and test

sediments. Physical analyses of the dredge material will include grain size, total organic carbon (TOC), and total solids.

- Grain size analysis will determine percentages of the general size classes that make up the sediment (gravel, sand, silt, and clay). Gravel and sand fractions will be separated using nested sieves; silt and clay fractions will be separated using the gravimetric/pipette method (Plumb 1981). The frequency distribution of the size ranges (reported in millimeters) of the sediments will be presented in the report.

- TOC, made up of volatile and nonvolatile organic compounds, will be determined by EPA Method 9060. Sediments will be treated with hydrochloric or sulfuric acid to remove the inorganic carbon (carbonates and bicarbonates) prior to TOC analysis (Plumb, 1981). Total solids will also be measured and used to convert concentrations of the chemical parameters from a wet-weight to a dry-weight basis.

- Total solids will be determined by weighing the organic and inorganic material remaining in a sample after it has been dried at a specific temperature. Total sulfides (EPA 9030) and ammonia, will also be measured. Porewater obtained by centrifugation will be analyzed for ammonia, pH and salinity using the standard laboratory water quality meters (Orion SA-720, Orion SA-250 and Orion 140, respectively).

Chemistry. Sediment chemistry is used to characterize potential contaminants at dredge spoils disposal sites. The test sediments and reference sediments will be examined based upon information presented in the Draft Regional Implementation Manual (RIM) for the State of Hawaii (ACOE/EPA 1997). Analyses will be conducted for Trace Metals, PCBs, Pesticides, Phenols, TRPH, PAHs and Orgaontins. In addition, test sediments will be analyzed for 15 priority pollutant metals using the Toxicity Characteristic Leaching Procedure (TCLP).

Analytical methods will be EPA Methods recommended by the U.S. EPA/ACOE (Green Book; 1991) and shown on Table 1. Organic tin analysis will use methodology described in Krone et al., 1988. Porewater will be analyzed for ammonia and sulfides using standard laboratory water quality meters and ion selective electrodes (Orion SA-720). Procedural blanks, reagent blanks, and standard reference materials will be analyzed, and results will be incorporated into a discussion of the analytical quality assurance and control parameters.

1.3.1.2 Procedures: Solid Phase

Solid phase bioassays will be used to estimate the potential impact of ocean disposal on benthic infauna. Dredge material will be evaluated using the 10-day solid phase test with the amphipod *Grandidierella japonica*, if available. If healthy *G. japonica* are not available, either *Rhepoxynius abronius* or *Ampelisca abdita* will be used. Prior to bioassay testing, ammonia (ion selective electrode), sulfides (photo-metric) and salinity (conductivity probe) will be measured within interstitial water from reference, test, and control-sediments. Sediments will press sieved through a 2.0 mm mesh to remove organisms, using only the water available in the sediment sample. Each sediment type (test, reference and control) will require five laboratory replicates. Control sediment will be sediments in which the organisms have been collected.

Experiments will be conducted in 1-liter glass test chambers containing a single 2-cm layer of test, reference or control material. Overlying water will be renewed every other day. Initial stocking densities will be 20 amphipods in each replicate. Aeration will be provided through glass or plastic pipettes, with care taken to avoid disturbing the sediment. Water quality measurements will be taken in one replicate from each test treatment daily and will include pH, salinity, temperature and dissolved oxygen. Ammonia will be measured at the start and finish of the test for each sediment type. All instruments used will be calibrated and logged daily. After 10 days, the animals will be carefully sieved from the sediments and counted.

Statistical methods described in the Green Book (EPA/COE, 1991) will be utilized to determine if significant mortality occurred. If control survival is below 90 percent, the test will be repeated. To evaluate the relative sensitivity of the organisms, reference toxicity tests will be conducted using standard reference toxicants (Lee, 1980).

1.3.1.3 Procedures: Suspended-Particulate Phase

Suspended-particulate phase (SPP) bioassay tests will be used to estimate potential impacts of ocean disposal on organisms living in the water column. The SPP test will be performed according to the Green Book (EPA/COE, 1991) using a 4:1 dilution of seawater to test sediment. The species to be tested is the bivalve larvae (either *Mytilus edulis* or *Crassostrea* sp.). The bivalve larva test will be run on the test sediment elutriates at concentrations of 0, 1, 10, 50 and 100 percent. The test (ASTM, 1992) will be run for 48 hours, or longer if necessary, for the development of the bivalve larvae to the "D-hinge" stage.

The ASTM method requires a test criterion of 70 percent survival of normally developed D-hinge larvae in the control treatment. At the termination of the study, point estimate statistical techniques (e.g., LC50, EC50, IC%) will be used to analyze the results.

1.3.1.4 Laboratory deliverables.

A draft report of bioassay testing results will be provided by Ogden Environmental and Energy Services. The report will include; all raw data sheets, a tabular summary of results for each test performed, a methods and materials section, including a narrative of the testing parameters and any difficulties encountered and a QA/QC section describing all quality control parameters and results.

A draft report of chemistry analysis results will be submitted by Columbia Analytical Services. This report will include; raw data sheets, a tabular summary of results for each analysis, methods and materials (including a narrative of procedures) and a QA/QC section.

1.3.2 LABORATORY QA/QC PROCEDURES

Quality assurance procedures to be used for sediment testing are consistent with methods described in the Green Book (EPA/COE, 1991). All samples will be tracked using chain-of-custody sheets and sample receipt logs. Sample storage conditions and holding times will be adhered to strictly.

1.3.2.1 QA/QC for Bioassays

The quality assurance objectives for toxicity testing are those detailed in U.S. EPA (1985a, 1985b) and the Green Book (EPA/COE, 1991). These objectives for accuracy and precision involve all aspects of the testing process, including: (1) water and sediment sampling and handling; (2) source and condition of test organisms;(3) condition of equipment; (4) test conditions; (5) instrument calibration; (6) use of reference toxicants; (7) record keeping; and (8) data evaluation. The methods employed in the toxicity testing program are detailed in Ogden's Laboratory Standard Operating Procedures (SOPs) and specific test protocols. These SOPs have been audited and approved by an independent, EPA recommended laboratory and placed in the QA files, as well as in laboratory files. All Ogden laboratory staff receive regular documented training in SOPs and test methods.

A reference toxicant will be tested on each test organism during the test period to establish the validity of the toxicity data. For those species with substantive reference toxicant data available, the LC50 and EC50 should fall within two standard deviations of the laboratory mean. Water quality measurements will be monitored to ensure they fall within prescribed limits, and corrective actions (EPA recommended) will be taken if necessary. All limits established for this program meet or exceed those recommended by EPA.

Data collected and produced as a result of analysis will be recorded on approved data sheets which will become the permanent data record for the program.

If any aspect of a test deviates from protocol, the test will be evaluated to determine whether it is valid according to the regulatory agency to which it will be submitted. If it is determined to be invalid, the client will be notified if necessary, and the test will be repeated.

Data Analysis, Validation and Reporting. All acute and chronic toxicity tests are performed according to protocols and conditions listed in Ogden's test protocols. Raw data and study records are checked to ensure that required test conditions are within specifications cited in the SOPs. Major deviations from protocol must be approved by both the client and the quality control manager. Unforeseen circumstances that may affect the integrity of the study are reported with the test results. The data, analysis and report are also reviewed for accuracy by the Quality Control Manager.

Internal Quality Control. Ogden's quality control staff performs periodic audits to ensure that test conditions, data collection and test procedures are conducted according to Green Book and Ogden protocols. Animal receipt and maintenance log books are used to record the source and health of organisms. Reference toxicant tests act as an internal check on organism health and performance.

Preventive Maintenance. Key analytical equipment is maintained routinely to ensure that equipment failure or changes in operational parameters can be prevented. Procedures used to maintain equipment are included in the Maintenance and Calibration Log. Replacement parts are available for commonly expected repairs and replacement. Spare parts include pH electrodes, dissolved oxygen (DO) probe membrane replacement kits, calibrated thermometers, pipettes, graduated cylinders, etc.

Stock standard solutions are stored in at least two separate containers, so that a fresh standard solution is available in case the stock standard currently in use becomes contaminated. Working standards which are in frequent contact with electrodes, pipettes, etc., are kept in separate working bottles to reduce chances of contamination of stock standards.

Procedures Used to Assess Data Precision, Accuracy, and Completeness. The precision of the reference toxicant LC50 determinations will be shown by calculating the 95 percent confidence intervals. The computer program used to analyze the data is designed in such a way that, regardless of the data characteristics, it will calculate an LC50 and corresponding confidence intervals as long as sufficient mortality is observed. Accuracy cannot be determined as a true value but rather must be determined relative to a reference value of the substance being measured.

The precision of all the analytical instruments (DO meter, pH meter, balances, etc.) is assumed to be that stipulated by the manufacturer. The accuracy of the measurements is assessed through daily calibration.

1.3.2.2 QA/QC for Chemical Analyses

Chemistry. For trace chemical analysis, the procedures include documentation of the following criteria for each sample matrix type: analytical reproducibility, analytical detection limits, recovery of *in situ* metals and organics, and chain of custody documentation.

The quality assurance objectives for chemical analysis conducted by Columbia Analytical Sciences (CAS) are detailed in their laboratory QA manual. These objectives for accuracy and precision involve all aspects of the testing process, including:

- Calibration methods and frequency
- Data analysis, validation, and reporting
- Internal quality control;
- Preventive maintenance
- Procedures to assure data accuracy and completeness

Laboratory QC samples. Environmental sample matrix spike and matrix spike duplicate analysis will be performed at a rate of 5%. Method or reagent blanks will be analyzed at a frequency of 5% or for every analytical batch, whichever is greater. In the absence of adequate sample quantity to perform matrix spiking for all matrix types, either the imaginary matrix as described in SW-846 or a laboratory water will be used for preparing matrix spikes. Matrix spikes are an environmental sample which is split into three separate aliquots and one aliquot is analyzed free from matrix spike introduction. A known concentration of the analyte of interest is added to the other two aliquots prior to sample preparation and analysis. Both percent recovery and relative percent difference are reported for matrix spikes/matrix spike duplicates. Spike data can provide an indication of matrix bias or interference on analyte recovery. Duplicate data can provide an indication of laboratory precision.

Results of all laboratory QC analyses will be reported with the final data. Any QC samples that fail to meet the QC criteria specified in the methodology or in this STP will be identified and the corresponding data appropriately qualified in the final report. All Quality Assurance/Quality Control records for the various testing programs will be kept on file for review by regulatory agency personnel.

1.3.3 REPORTING

MEC will provide a draft report, which will include field sampling results and bioassay and chemistry results. The Field Sampling report will include core logs, photographs and descriptions of all core samples. Methods and materials used during the sampling, locations of all sample stations in degrees latitude and longitude using differential GPS data. Description of any deviations made from the sampling plan.

Bioassay and chemistry analysis reports will include bulk chemistry (raw) data, a tabular summary of results for all analyses, methods and materials used for the analyses and a QA/QC section describing all appropriate laboratory quality control parameters and results.

Results will be summarized and evaluated in the EIS by Belt Collins Hawaii.

1.4 REFERENCES

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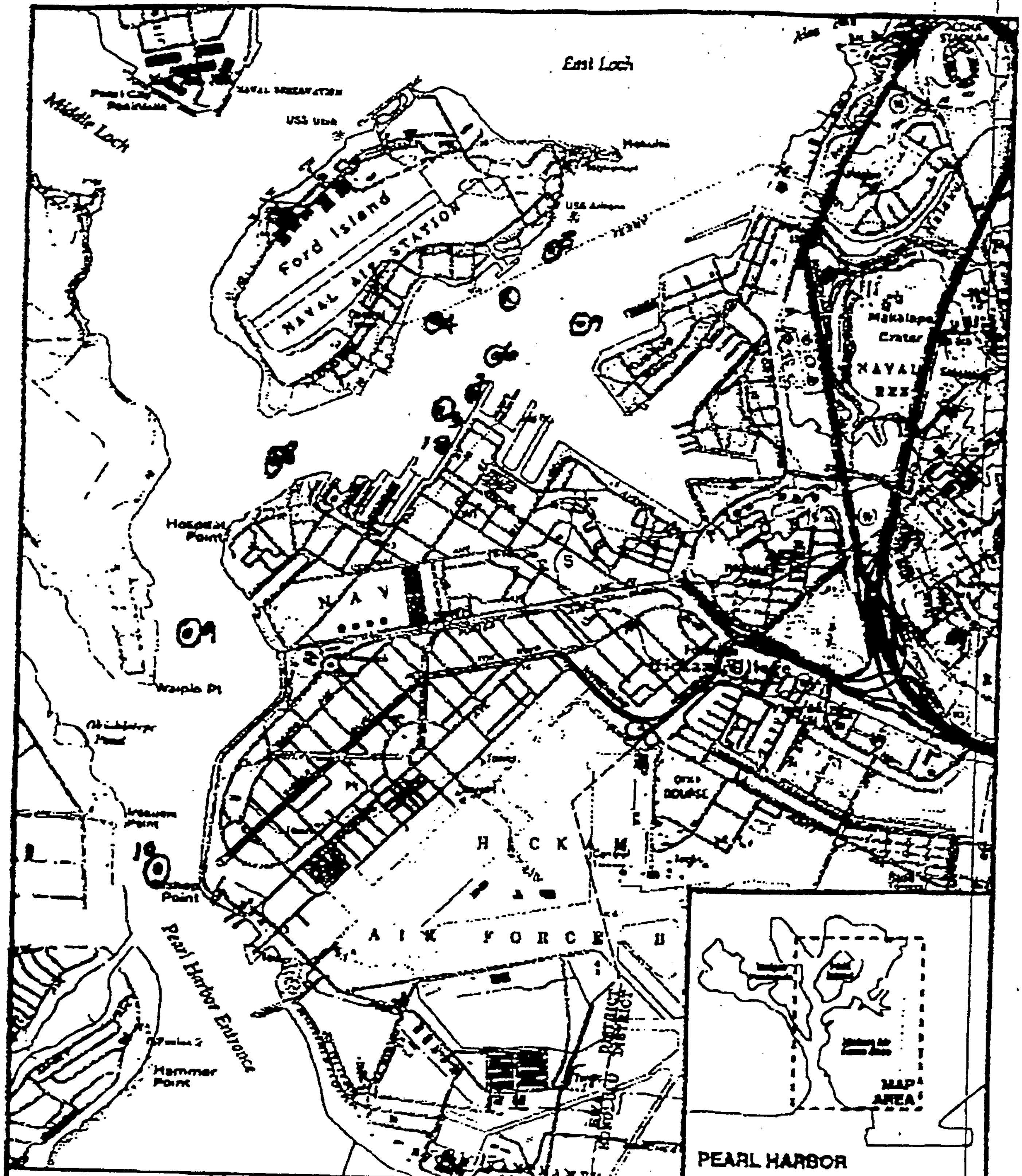


NORTH

0 600 1200 2400
SCALE IN FEET

Figure

CVN Homeport Analysis
Prepared by Belt Collins Hawaii
September 1997

APPENDIX B

WATER QUALITY OBSERVATIONS

AMPHIPOD BIOASSAYS

Appendix Table B-1. 10-Day Solid Phase Bioassay with *Grandidierella japonica*

CONTROL										
Day	Temperature (°C)		Dissolved O_2 (mg/L)		pH (units)		Salinity (ppt)		NH_3 (mg/L)
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
0	15.9		8.1		7.69		30		0.1*
1	14.6		8.6		7.87		29		
2	14.8	14.5	8.0	8.6	7.89	8.02	30	29	
3	14.8		8.3		7.94		29		
4	14.8	15.0	8.0	8.2	7.94	7.98	28	29	
5	14.9		8.3		7.98		30		
6	16.2	15.0	7.4	8.3	8.01	8.01	30	30	
7	14.8		8.2		7.88		31		
8	14.9	14.6	8.3	8.5	7.93	7.81	30	31	
9	14.6		8.5		7.69		30		
10		15.4		8.7		7.88		30	3.1

*Sample was measured using an ion electrode in place of the spectrophotometer.

Appendix Table B-2. 10-Day Solid Phase Bioassay with *Grandidierella japonica*

Reference										
Day	Temperature (°C)		Dissolved O_2 (mg/L)		pH (units)		Salinity (ppt)		NH_3 (mg/L)
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
0	16.0		8.2		8.09		30		0.4*
1	14.7		8.4		7.90		29		
2	14.8	14.4	8.0	8.5	7.89	8.05	30	29	
3	14.6		8.3		8.01		29		
4	14.8	15.1	8.0	7.9	7.94	8.03	28	29	
5	14.8		8.2		8.03		30		
6	16.2	14.8	7.4	8.3	8.01	8.08	30	30	
7	14.8		8.1		7.93		31		
8	14.9	14.5	8.3	8.6	7.93	7.88	30	31	
9	14.5		8.6		7.79		31		
10		15.4		8.8		7.95		31	4.1

*Sample was measured using an ion electrode in place of the spectrophotometer.

Appendix Table B-3. 10-Day Solid Phase Bioassay with *Grandidierella japonica*

1-2T										
Day	Temperature (°C)		Dissolved O_2 (mg/L)		pH (units)		Salinity (ppt)		NH_3 (mg/L)
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
0	16.0		7.8		8.01		30		0.904*
1	15.1		8.6		7.97		29		
2	14.8	14.4	8.0	8.6	7.89	8.10	30	29	
3	14.6		8.1		8.04		30		
4	14.8	15.0	8.0	8.2	7.94	8.04	28	30	
5	15.1		8.2		8.04		31		
6	16.2	14.8	7.4	8.1	8.01	8.07	30	31	
7	14.9		8.1		7.92		31		
8	14.9	14.5	8.3	8.6	7.93	7.87	30	31	
9	14.4		8.7		7.83		31		
10		15.2		8.8		7.98		30	3.5

*Sample was measured using an ion electrode in place of the spectrophotometer.

Appendix Table B-4. 10-Day Solid Phase Bioassay with *Grandidierella japonica*

1-2B										
Day	Temperature (°C)		Dissolved O_2 (mg/L)		pH (units)		Salinity (ppt)		NH_3 (mg/L)
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
0	16.0		7.8		8.10		30		4.71*
1	15.1		8.5		8.02		29		
2	14.8	14.4	8.0	8.5	7.89	8.27	30	29	
3	14.5		8.2		8.20		29		
4	14.8	15.2	8.0	8.0	7.94	8.19	28	29	
5	14.9		8.2		8.14		31		
6	16.2	15.0	7.4	8.2	8.01	8.17	30	31	
7	15.0		8.0		7.98		30		
8	14.9	14.5	8.3	8.5	7.93	8.00	30	31	
9	14.5		8.7		7.89		30		
10		15.4		8.6		8.00		30	7.0

*Sample was measured using an ion electrode in place of the spectrophotometer.

Appendix Table B-5. 10-Day Solid Phase Bioassay with *Grandidierella japonica*

Site 3										
Day	Temperature (°C)		Dissolved O_2 (mg/L)		pH (units)		Salinity (ppt)		NH_3 (mg/L)
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
0	16.0		8.1		7.89		30		3.4
1	14.6		8.5		8.14		29		
2	14.8	14.5	8.0	8.5	7.89	8.27	30	29	
3	14.6		8.2		8.18		29		
4	14.8	15.1	8.0	8.2	7.94	8.18	28	29	
5	14.9		8.3		8.16		31		
6	16.2	14.9	7.4	8.3	8.01	8.19	30	31	
7	14.9		8.2		7.99		31		
8	14.9	14.5	8.3	8.4	7.93	7.95	30	31	
9	14.5		8.7		7.89		30		
10		15.4		8.7		8.04		31	5.5

Appendix Table B-6. 10-Day Solid Phase Bioassay with *Grandidierella japonica*

Site 4										
Day	**Temperature (°C)**		**Dissolved O_2 (mg/L)**		**pH (units)**		**Salinity (ppt)**		**NH_3 (mg/L)**
	Initial	**Final**	**Initial**	**Final**	**Initial**	**Final**	**Initial**	**Final**	
0	16.0		7.3		8.02		30		7.7
1	14.8		8.5		8.22		29		
2	14.8	14.4	8.0	8.5	7.89	8.33	30	29	
3	14.6		8.3		8.24		30		
4	14.8	15.1	8.0	8.1	7.94	8.23	28	30	
5	15.0		8.3		8.21		31		
6	16.2	15.0	7.4	8.1	8.01	8.22	30	31	
7	15.0		8.1		8.03		31		
8	14.9	14.5	8.3	8.5	7.93	7.99	30	31	
9	14.5		8.6		7.94		31		
10		15.4		8.7		8.05		30	8.3

Appendix Table B-7. 10-Day Solid Phase Bioassay with *Grandidierella japonica*

Site 5										
Day	Temperature (°C)		Dissolved O_2 (mg/L)		pH (units)		Salinity (ppt)		NH_3 (mg/L)
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
0	16.0		8.0		7.82		30		2.3
1	14.7		8.5		8.02		29		
2	14.8	14.5	8.0	8.5	7.89	8.12	30	29	
3	14.6		8.4		8.08		29		
4	14.8	15.1	8.0	8.1	7.94	8.07	28	29	
5	14.9		8.2		8.07		31		
6	16.2	15.0	7.4	8.2	8.01	8.09	30	31	
7	15.0		8.2		7.94		31		
8	14.9	14.6	8.3	8.6	7.93	7.89	30	31	
9	14.5		8.6		7.91		30		
10		15.5		8.7		8.03		30	4.3

Appendix Table B-8. 10-Day Solid Phase Bioassay with *Grandidierella japonica*

Site 6										
Day	Temperature (°C)		Dissolved O_2 (mg/L)		pH (units)		Salinity (ppt)		NH_3 (mg/L)
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
0	16.0		7.6		8.08		30		3.5
1	14.7		8.5		8.12		29		
2	14.8	14.6	8.0	8.5	7.89	8.23	30	29	
3	14.8		8.2		8.18		29		
4	14.8	15.2	8.0	8.1	7.94	8.18	28	29	
5	15.0		8.2		8.14		31		
6	16.2	15.0	7.4	8.2	8.01	8.18	30	31	
7	15.1		8.1		8.08		30		
8	14.9	14.6	8.3	8.5	7.93	7.98	30	30	
9	14.6		8.6		7.96		30		
10		15.4		8.7		8.07		30	5.2

Appendix Table B-9. 10-Day Solid Phase Bioassay with *Grandidierella japonica*

Site 7										
Day	Temperature (°C)		Dissolved O_2 (mg/L)		pH (units)		Salinity (ppt)		NH_3 (mg/L)
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
0	16.0		8.2		8.09		30		4.0
1	14.8		8.5		8.21		29		
2	14.8	14.6	8.0	8.5	7.89	8.30	30	29	
3	14.8		8.2		8.24		30		
4	14.8	15.1	8.0	8.0	7.94	8.23	28	30	
5	15.0		8.2		8.16		31		
6	16.2	15.1	7.4	8.1	8.01	8.17	30	30	
7	15.1		8.0		8.01		30		
8	14.9	14.6	8.3	8.3	7.93	7.97	30	30	
9	14.6		8.6		7.96		30		
10		15.4		8.6		8.07		30	6.0

Appendix Table B-10. 10-Day Solid Phase Bioassay with *Grandidierella japonica*

Site 8

Day	Temperature (°C) Initial	Temperature (°C) Final	Dissolved O_2 (mg/L) Initial	Dissolved O_2 (mg/L) Final	pH (units) Initial	pH (units) Final	Salinity (ppt) Initial	Salinity (ppt) Final	NH_3 (mg/L)
0	16.0		8.5		8.08		30		2.0
1	14.8		8.6		8.01		29		
2	14.8	14.6	8.0	8.4	7.89	8.14	30	29	
3	14.8		8.4		8.09		29		
4	14.8	15.1	8.0	8.1	7.94	8.09	28	29	
5	15.0		8.2		8.07		31		
6	16.2	15.2	7.4	8.2	8.01	8.09	30	30	
7	15.1		8.1		7.94		30		
8	14.9	14.6	8.3	8.5	7.93	7.89	30	30	
9	14.6		8.6		7.93		30		
10		15.5		8.6		8.02		30	3.8

Appendix Table B-11. 10-Day Solid Phase Bioassay with *Grandidierella japonica*

Site 9										
Day	Temperature (°C)		Dissolved O_2 (mg/L)		pH (units)		Salinity (ppt)		NH_3 (mg/L)
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	
0	16.0		7.8		8.10		30		2.2
1	14.9		8.4		7.97		29		
2	14.8	14.5	8.0	8.5	7.89	8.09	30	29	
3	14.8		8.3		8.05		29		
4	14.8	15.2	8.0	8.1	7.94	8.06	28	29	
5	15.1		8.2		8.05		31		
6	16.2	15.1	7.4	8.1	8.01	8.07	30	30	
7	15.1		8.1		7.98		30		
8	14.9	14.5	8.3	8.4	7.93	7.89	30	30	
9	14.6		8.6		7.93		30		
10		15.5		8.6		8.01		30	1.5

Appendix Table B-12. 10-Day Solid Phase Bioassay with *Grandidierella japonica*

Site 10										
Day	**Temperature (°C)**		**Dissolved O_2 (mg/L)**		**pH (units)**		**Salinity (ppt)**		**NH_3 (mg/L)**
	Initial	**Final**	**Initial**	**Final**	**Initial**	**Final**	**Initial**	**Final**	
0	16.0		8.1		7.96		30		1.3
1	14.8		8.5		7.91		29		
2	14.8	14.7	8.0	8.5	7.89	8.02	30	29	
3	14.8		8.3		8.01		29		
4	14.8	15.1	8.0	8.1	7.94	8.00	28	29	
5	15.1		8.2		8.01		31		
6	16.2	15.1	7.4	8.2	8.01	8.02	30	30	
7	15.1		8.2		7.88		30		
8	14.9	14.5	8.3	8.5	7.93	7.93	30	30	
9	14.6		8.7		7.93		30		
10		15.5		8.6		8.01		30	2.7

BIVALVE BIOASSAYS

Appendix Table B-13. Bivalve Larvae Water Quality

Pearl Harbor Homeporting Project

Test Site	Dissolved O_2 (mg/L)				pH (units)				Salinity (ppt)				Temperature (°C)				NH_3 (mg/L)	
	0	24	48	67	0	24	48	67	0	24	48	67	0	24	48	67	0	67
Lab Control	8.7	7.3	7.2	6.5	8.07	7.85	7.87	7.62	33	33	34	34	20.3	20.4	20.4	20.4	1.5	0.0
Reference	8.1	6.4	6.7	6.5	7.95	7.76	7.84	7.63	33	33	35	35	20.3	20.3	20.4	20.6	0.9	0.0
1-2T	5.9	6.4	6.9	6.5	8.28	8.00	8.01	7.79	33	33	34	34	20.3	20.4	20.4	20.4	4.9	4.9
1-2B	6.1	6.6	6.8	6.4	8.18	8.09	8.13	7.97	33	33	34	34	20.3	20.4	20.4	20.4	14.3	17.0
3	5.8	6.8	6.9	6.5	8.19	8.10	8.18	8.01	33	33	34	34	20.3	20.4	20.4	20.4	13.7	12.8
4	5.0	6.7	6.8	6.6	8.23	8.12	8.20	8.05	33	33	34	34	20.3	20.4	20.4	20.4	19.2	15.5
5	6.1	6.7	6.9	6.8	7.90	7.88	7.99	7.86	33	33	34	34	20.3	20.4	20.4	20.6	5.2	4.3
6	5.6	6.7	6.9	6.6	8.22	8.09	8.15	8.00	33	33	34	34	20.3	20.4	20.4	20.4	12.6	11.5
7	5.8	6.9	6.9	6.6	8.21	8.10	8.17	8.01	33	33	34	34	20.3	20.4	20.4	20.4	12.9	11.2
8	7.0	6.9	7.0	6.9	8.05	7.97	8.04	7.88	33	33	34	34	20.3	20.4	20.4	20.6	6.3	5.2
9	6.2	6.8	7.1	6.9	8.22	8.00	8.02	7.84	33	33	34	34	20.3	20.5	20.4	20.6	2.9	3.7
10	7.3	7.1	7.1	6.9	8.32	7.96	7.90	7.70	33	33	34	34	20.3	20.4	20.4	20.3	0.0	0.0

APPENDIX C

TEST SITE STATISTICAL ANALYSES

AMPHIPOD

Amphipod 10-day Survival Bioassay-Proportion Alive

Start Date:	11/4/97	Test ID:	9711-023	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/14/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 93	Test Species:	GJ-Grandidierella japonica
Comments:	Site: 1-2T				

Conc-	1	2	3	4	5
REF-Control	0.9000	0.8500	0.9500	1.0000	1.0000
1-2T	0.9000	0.9000	0.8500	0.9500	1.0000

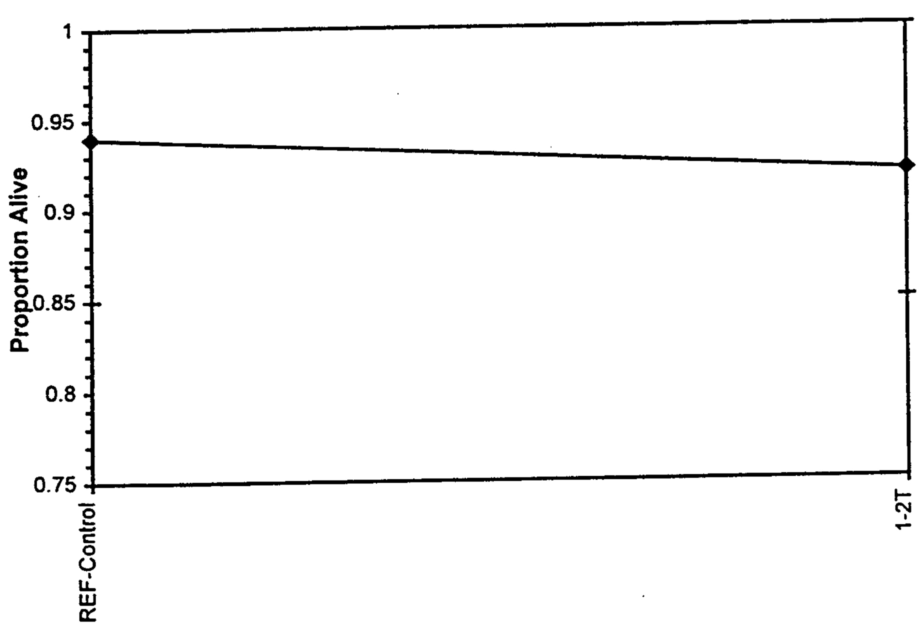
			Transform: Untransformed						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
REF-Control	0.9400	1.0000	0.9400	0.8500	1.0000	6.935	5			
1-2T	0.9200	0.9787	0.9200	0.8500	1.0000	6.197	5	0.516	1.860	0.0028

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95286	0.781	-0.1299	-1.1925
F-Test indicates equal variances (p = 0.80)	1.30769	23.1539		

Hypothesis Test (1-tail, 0.05)

Homoscedastic t Test indicates no significant differences

Dose-Response Plot



ToxCalc v5.0

Reviewed by: *MA*

Amphipod 10-day Survival Bioassay-Proportion Alive

Start Date:	11/4/97	Test ID:	9711-024	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/14/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 93	Test Species:	GJ-Grandidierella japonica
Comments:	Site: 1-2B				

Conc-	1	2	3	4	5
REF-Control	0.9000	0.8500	0.9500	1.0000	1.0000
1-2B	0.9000	0.8500	0.9000	0.9500	0.8500

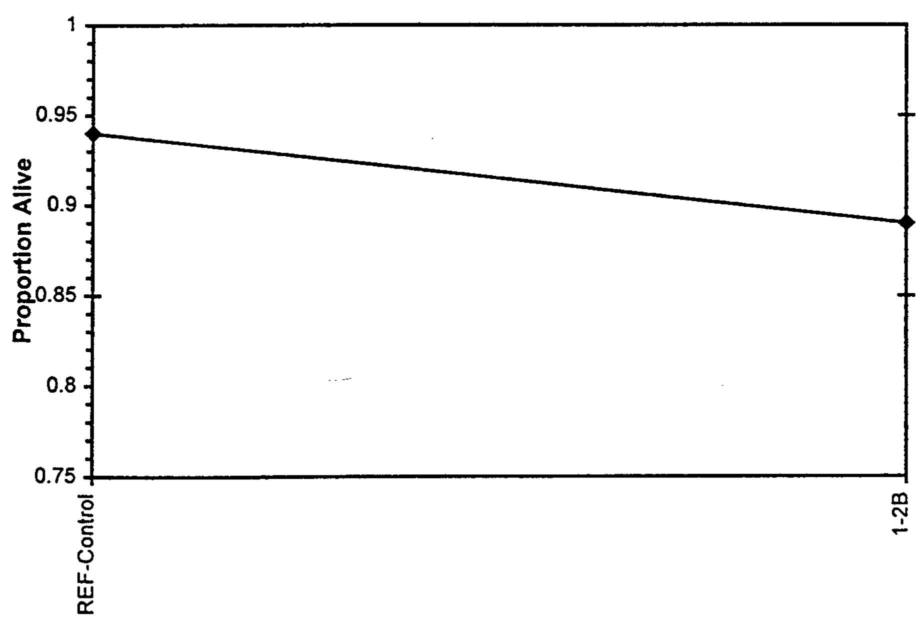
			Transform: Untransformed						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
REF-Control	0.9400	1.0000	0.9400	0.8500	1.0000	6.935	5			
1-2B	0.8900	0.9468	0.8900	0.8500	0.9500	4.700	5	1.443	1.860	0.0022

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.89457	0.781	-0.2723	-0.8956
F-Test indicates equal variances (p = 0.41)	2.42857	23.1539		

Hypothesis Test (1-tail, 0.05)

Homoscedastic t Test indicates no significant differences

Dose-Response Plot



ToxCalc v5.0

Reviewed by: [signature]

Amphipod 10-day Survival Bioassay-Proportion Alive

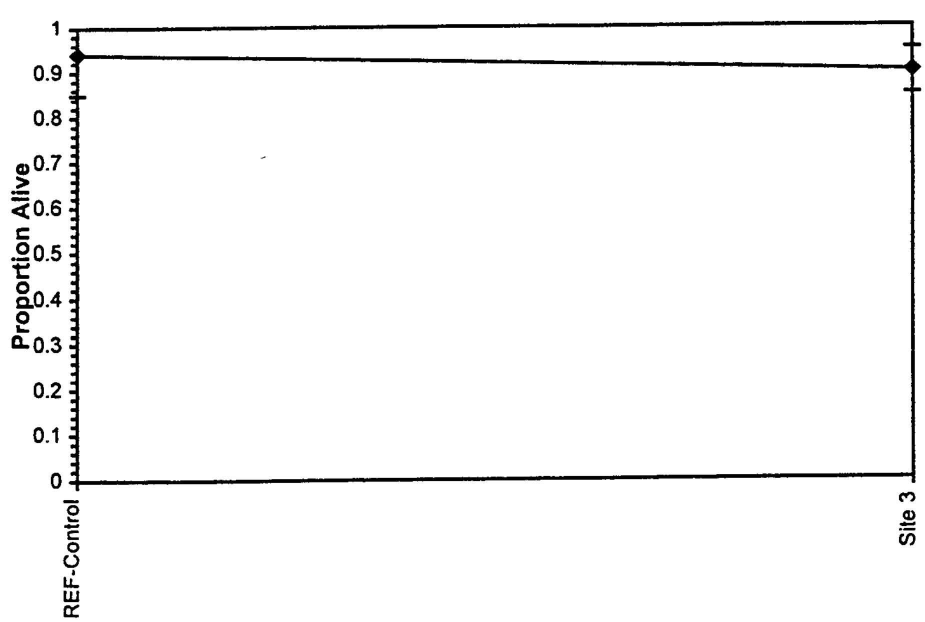
Start Date:	11/4/97	Test ID:	9711-025	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/14/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 93	Test Species:	GJ-Grandidierella japonica
Comments:	Site: 3				

Conc-	1	2	3	4	5
REF-Control	0.9000	0.8500	0.9500	1.0000	1.0000
Site 3	0.9500	0.9000	0.9000	0.8500	0.9000

			Transform: Untransformed					1-Tailed		
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
REF-Control	0.9400	1.0000	0.9400	0.8500	1.0000	6.935	5			
Site 3	0.9000	0.9574	0.9000	0.8500	0.9500	3.928	5	1.206	1.860	0.0020

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.92663	0.781	-0.4137	-0.4456
F-Test indicates equal variances (p = 0.26)	3.4	23.1539		
Hypothesis Test (1-tail, 0.05)				
Homoscedastic t Test indicates no significant differences				

Dose-Response Plot



ToxCalc v5.0

Reviewed by: Mh

Amphipod 10-day Survival Bioassay-Proportion Alive

Start Date:	11/4/97	Test ID:	9711-026	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/14/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 93	Test Species:	GJ-Grandidierella japonica
Comments:	Site: 4				

Conc-	1	2	3	4	5
REF-Control	0.9000	0.8500	0.9500	1.0000	1.0000
Site 4	0.8000	0.9500	0.9500	0.9000	1.0000

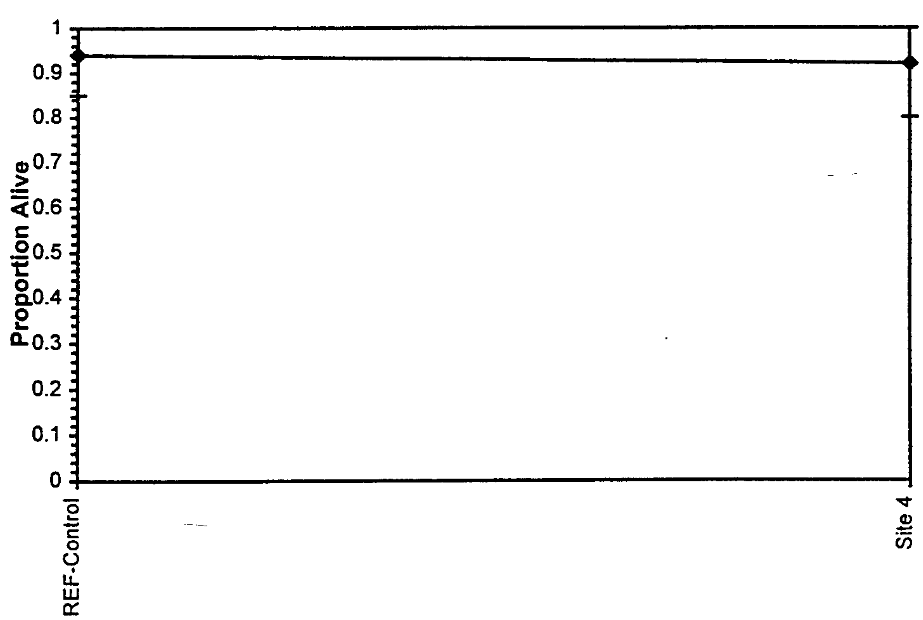
			Transform: Untransformed						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
REF-Control	0.9400	1.0000	0.9400	0.8500	1.0000	6.935	5			
Site 4	0.9200	0.9787	0.9200	0.8000	1.0000	8.242	5	0.447	1.860	0.0037

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.92615	0.781	-0.7172	-0.5362
F-Test indicates equal variances (p = 0.78)	1.35294	23.1539		

Hypothesis Test (1-tail, 0.05)

Homoscedastic t Test indicates no significant differences

Dose-Response Plot



 ToxCalc v5.0 Reviewed by: MH

Amphipod 10-day Survival Bioassay-Proportion Alive

Start Date:	11/4/97	Test ID:	9711-027	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/14/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 93	Test Species:	GJ-Grandidierella japonica
Comments:	Site: 5				

Conc-	1	2	3	4	5
REF-Control	0.9000	0.8500	0.9500	1.0000	1.0000
Site 5	0.9500	0.9000	0.9500	0.9000	0.9500

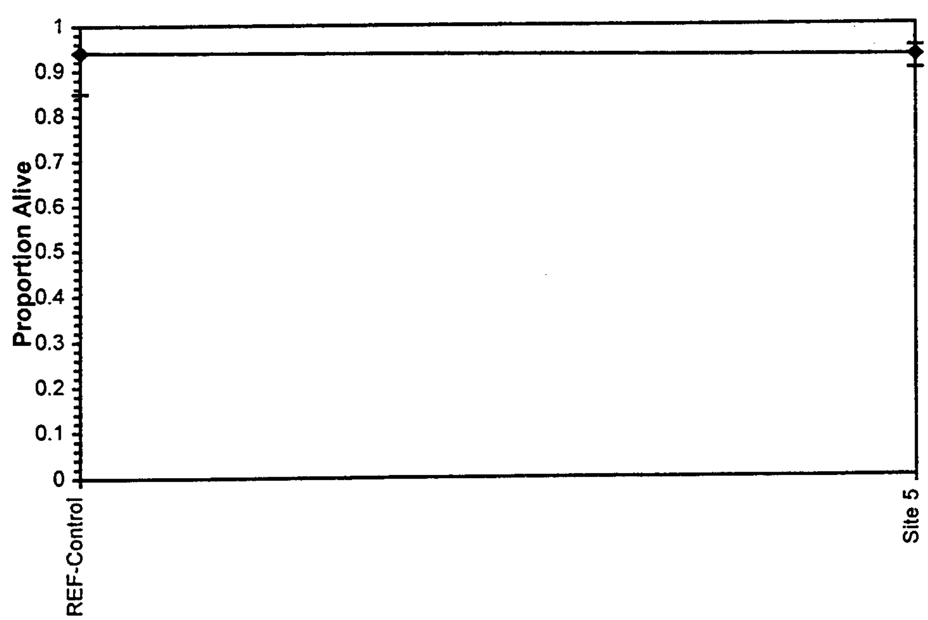
			Transform: Untransformed						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
REF-Control	0.9400	1.0000	0.9400	0.8500	1.0000	6.935	5			
Site 5	0.9300	0.9894	0.9300	0.9000	0.9500	2.945	5	0.316	1.860	0.0019

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.92778	0.781	-0.5171	-0.0876
F-Test indicates equal variances (p = 0.12)	5.66667	23.1539		

Hypothesis Test (1-tail, 0.05)

Homoscedastic t Test indicates no significant differences

Dose-Response Plot



ToxCalc v5.0

Reviewed by: LAL

Amphipod 10-day Survival Bioassay-Proportion Alive

Start Date:	11/4/97	Test ID:	9711-028	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/14/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 93	Test Species:	GJ-Grandidierella japonica
Comments:	Site: 6				

Conc-	1	2	3	4	5
REF-Control	0.9000	0.8500	0.9500	1.0000	1.0000
Site 6	1.0000	0.9500	1.0000	0.9500	0.9500

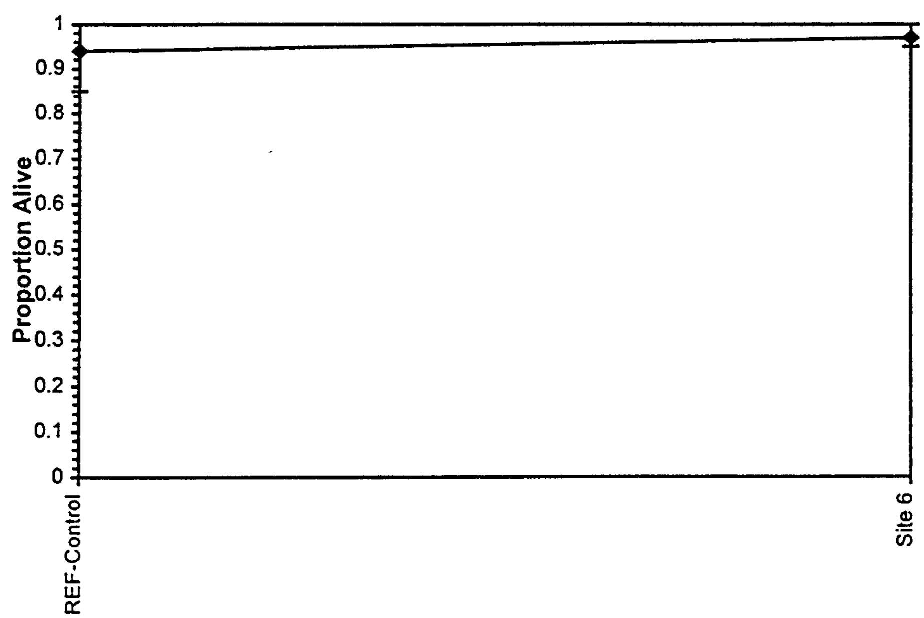
			Transform: Untransformed						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
REF-Control	0.9400	1.0000	0.9400	0.8500	1.0000	6.935	5			
Site 6	0.9700	1.0319	0.9700	0.9500	1.0000	2.823	5	-0.949	1.860	0.0019

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.93868	0.781	-0.4375	-0.0876
F-Test indicates equal variances (p = 0.12)	5.66667	23.1539		

Hypothesis Test (1-tail, 0.05)

Homoscedastic t Test indicates no significant differences

Dose-Response Plot



 ToxCalc v5.0 Reviewed by: MH

Amphipod 10-day Survival Bioassay-Proportion Alive

Start Date:	11/4/97	Test ID:	9711-029	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/14/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 93	Test Species:	GJ-Grandidierella japonica
Comments:	Site: 7				

Conc-	1	2	3	4	5
REF-Control	0.9000	0.8500	0.9500	1.0000	1.0000
Site 7	0.7500	0.9500	0.9500	1.0000	0.9500

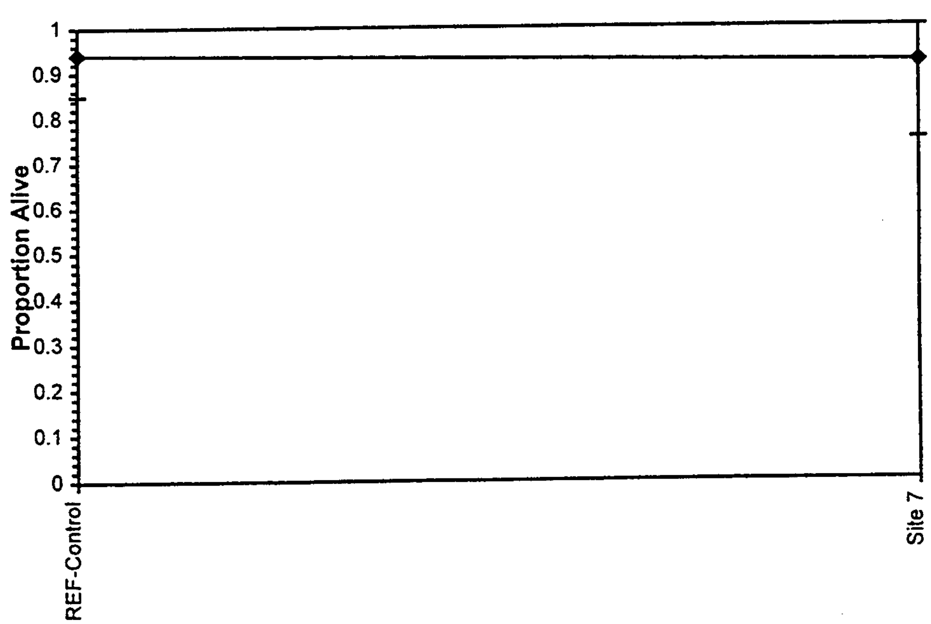
			Transform: Untransformed						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
REF-Control	0.9400	1.0000	0.9400	0.8500	1.0000	6.935	5			
Site 7	0.9200	0.9787	0.9200	0.7500	1.0000	10.594	5	0.381	1.860	0.0051

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.85378	0.781	-1.3606	1.34532
F-Test indicates equal variances (p = 0.46)	2.23529	23.1539		

Hypothesis Test (1-tail, 0.05)

Homoscedastic t Test indicates no significant differences

Dose-Response Plot



ToxCalc v5.0

Reviewed by: Mh

Amphipod 10-day Survival Bioassay-Proportion Alive

Start Date:	11/4/97	Test ID:	9711-030	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/14/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 93	Test Species:	GJ-Grandidierella japonica
Comments:	Site: 8				

Conc-	1	2	3	4	5
REF-Control	0.9000	0.8500	0.9500	1.0000	1.0000
Site 8	1.0000	1.0000	0.9500	0.9000	1.0000

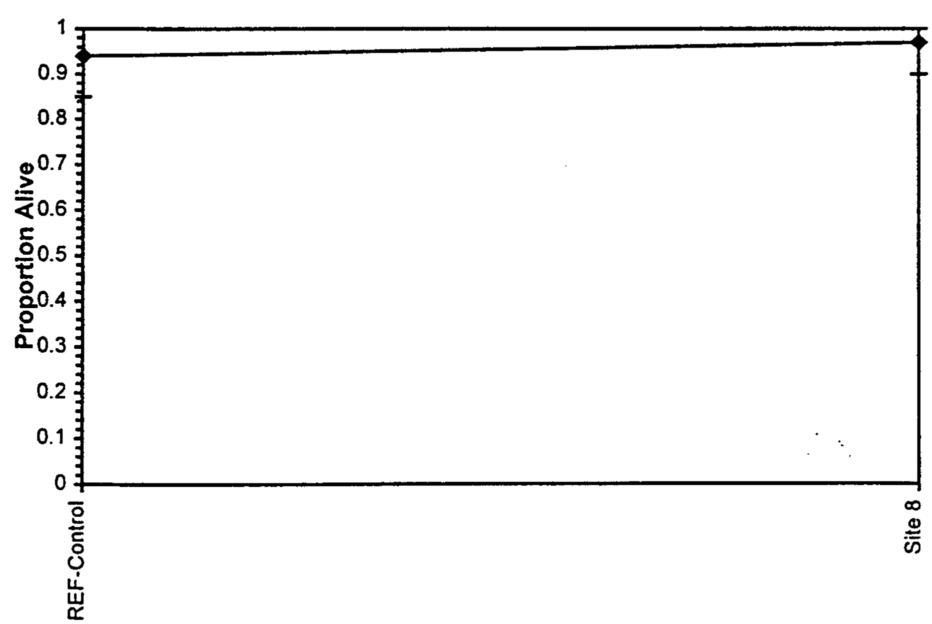
			Transform: Untransformed						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
REF-Control	0.9400	1.0000	0.9400	0.8500	1.0000	6.935	5			
Site 8	0.9700	1.0319	0.9700	0.9000	1.0000	4.610	5	-0.849	1.860	0.0023

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.9093	0.781	-0.5977	-0.9252
F-Test indicates equal variances (p = 0.48)	2.125	23.1539		

Hypothesis Test (1-tail, 0.05)

Homoscedastic t Test indicates no significant differences

Dose-Response Plot



ToxCalc v5.0

Reviewed by: Mh

Amphipod 10-day Survival Bioassay-Proportion Alive

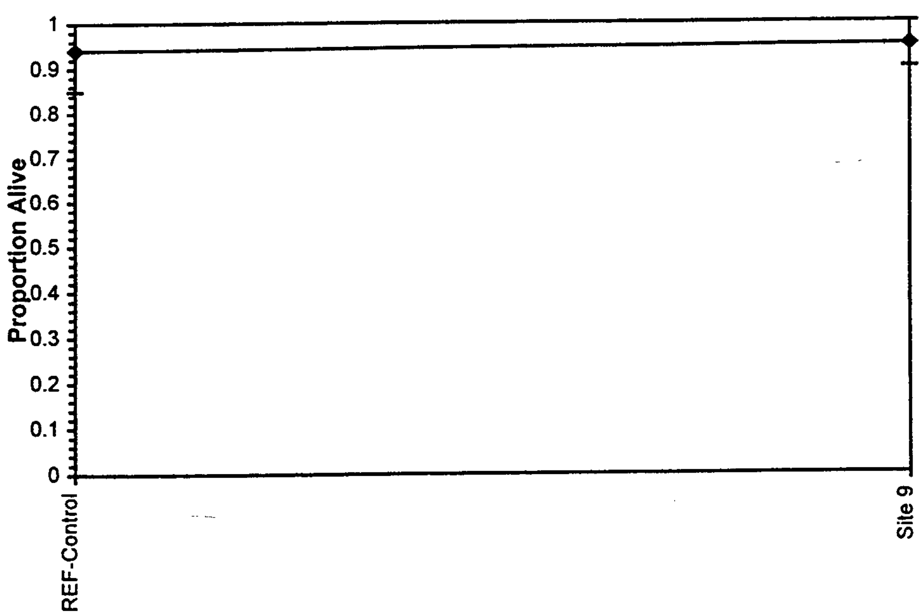
Start Date:	11/4/97	Test ID:	9711-031	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/14/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 93	Test Species:	GJ-Grandidierella japonica
Comments:	Site: 9				

Conc-	1	2	3	4	5
REF-Control	0.9000	0.8500	0.9500	1.0000	1.0000
Site 9	0.9500	0.9000	0.9500	0.9500	1.0000

			Transform: Untransformed						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
REF-Control	0.9400	1.0000	0.9400	0.8500	1.0000	6.935	5			
Site 9	0.9500	1.0106	0.9500	0.9000	1.0000	3.722	5	-0.302	1.860	0.0020

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.92663	0.781	-0.4137	-0.4456
F-Test indicates equal variances (p = 0.26)	3.4	23.1539		
Hypothesis Test (1-tail, 0.05)				
Homoscedastic t Test indicates no significant differences				

Dose-Response Plot



ToxCalc v5.0

Reviewed by: MM

Amphipod 10-day Survival Bioassay-Proportion Alive

Start Date:	11/4/97	Test ID:	9711-032	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/14/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 93	Test Species:	GJ-Grandidierella japonica
Comments:	Site: 10				

Conc-	1	2	3	4	5
REF-Control	0.9000	0.8500	0.9500	1.0000	1.0000
Site 10	0.9500	1.0000	0.9000	1.0000	0.9000

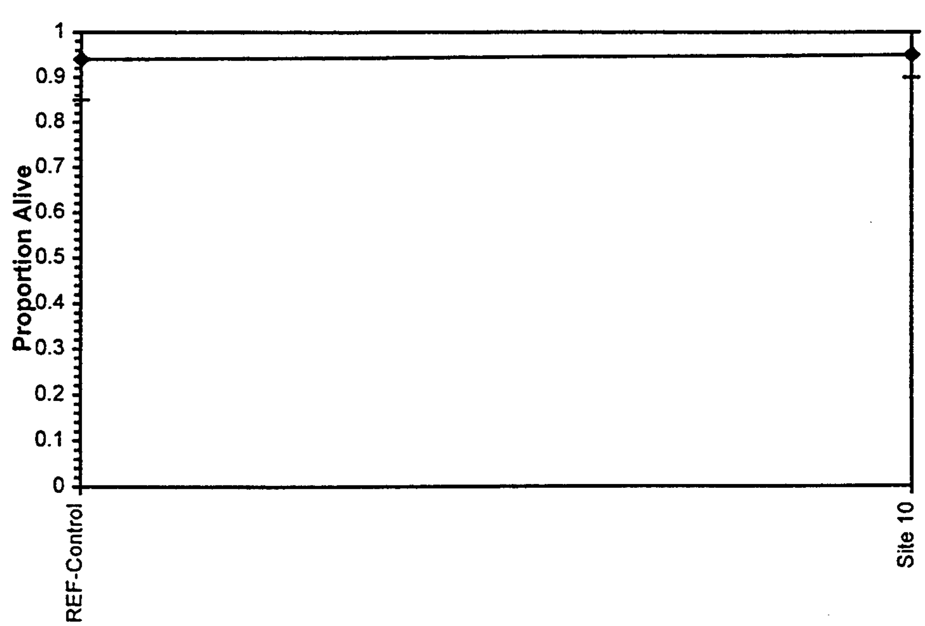
			Transform: Untransformed						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
REF-Control	0.9400	1.0000	0.9400	0.8500	1.0000	6.935	5			
Site 10	0.9500	1.0106	0.9500	0.9000	1.0000	5.263	5	-0.272	1.860	0.0025

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.89109	0.781	-0.3043	-1.4511
F-Test indicates equal variances (p = 0.62)	1.7	23.1539		

Hypothesis Test (1-tail, 0.05)

Homoscedastic t Test indicates no significant differences

Dose-Response Plot



 ToxCalc v5.0 Reviewed by: RM

BIVALVE

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID:	9711-011	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: REFERENCE				

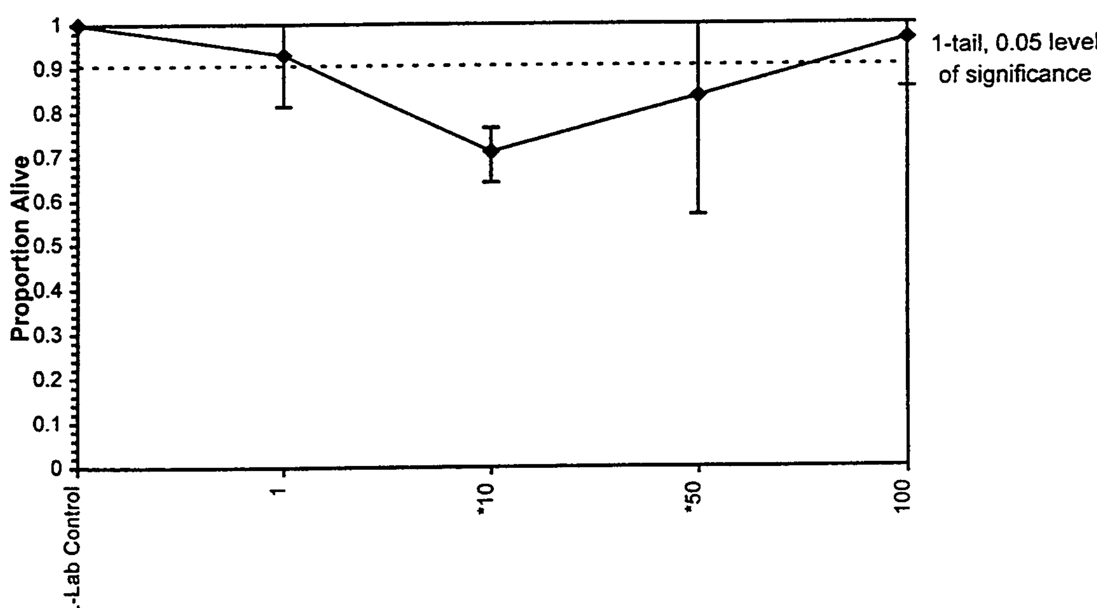
Conc-	1	2	3	4	5
L-Lab Control	1.0000	1.0000	1.0000	1.0000	1.0000
1	0.8799	0.9868	1.0000	0.8141	0.9704
10	0.6414	0.7237	0.7648	0.6826	0.7401
50	0.8388	0.5674	1.0000	1.0000	0.7730
100	0.8553	0.9704	1.0000	1.0000	1.0000

			Transform: Arcsin Square Root						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
L-Lab Control	1.0000	1.0000	1.4269	1.4269	1.4269	0.000	5			
1	0.9303	0.9303	1.3245	1.1251	1.4558	10.971	5	1.170	2.300	0.2012
*10	0.7105	0.7105	1.0037	0.9288	1.0645	5.344	5	4.838	2.300	0.2012
*50	0.8359	0.8359	1.1878	0.8530	1.4269	20.633	5	2.734	2.300	0.2012
100	0.9651	0.9651	1.3718	1.1805	1.4269	7.849	5	0.630	2.300	0.2012

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94123	0.888	-0.5345	1.39375
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	>100			0.09386	0.09583	0.14422	0.01913	7.1E-04	4, 20

Dose-Response Plot



 ToxCalc v5.0 Reviewed by: MA

Bivalve Larval Survival and Development Test-Proportion Normal

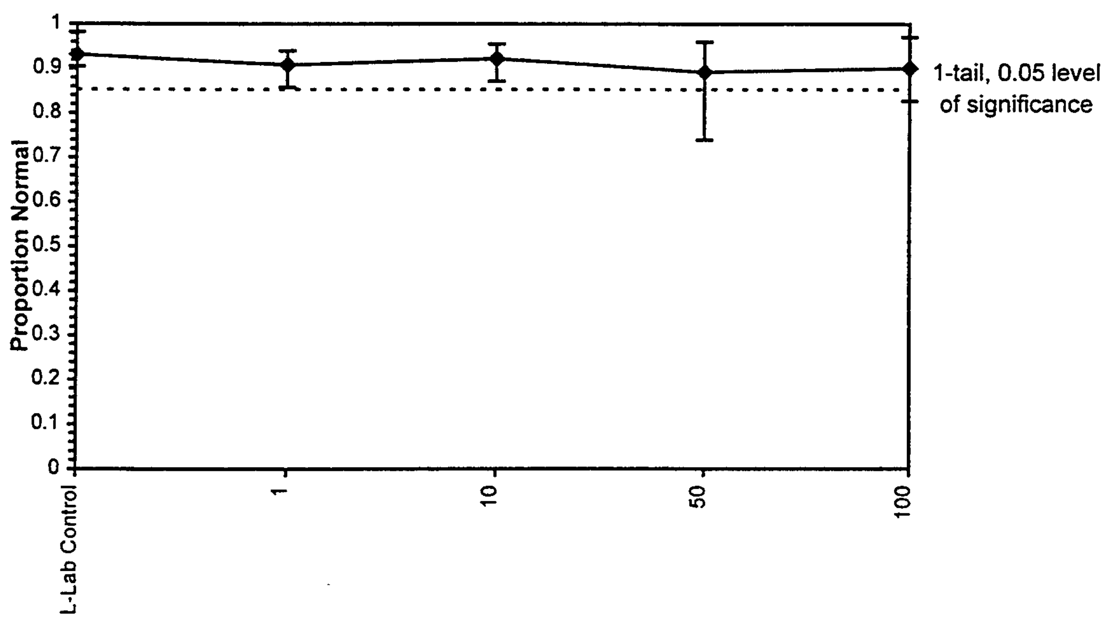
Start Date:	11/7/97	Test ID:	9711-011	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: REFERENCE				

Conc-	1	2	3	4	5
L-Lab Control	0.9138	0.9444	0.9817	0.9091	0.9040
1	0.8972	0.9167	0.8581	0.9293	0.9407
10	0.8974	0.9545	0.8710	0.9518	0.9333
50	0.9608	0.9130	0.9111	0.7397	0.9362
100	0.9712	0.9407	0.8271	0.8873	0.8776

			Transform: Arcsin Square Root						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
L-Lab Control	0.9306	1.0000	1.3122	1.2558	1.4349	5.715	5			
1	0.9084	0.9761	1.2667	1.1845	1.3248	4.319	5	0.807	2.300	0.1297
10	0.9216	0.9904	1.2926	1.2034	1.3559	5.158	5	0.346	2.300	0.1297
50	0.8922	0.9587	1.2524	1.0354	1.3714	10.244	5	1.061	2.300	0.1297
100	0.9008	0.9679	1.2617	1.1419	1.4001	8.018	5	0.895	2.300	0.1297

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.96351		0.888		-0.5392	0.76269
Bartlett's Test indicates equal variances (p = 0.50)					3.36252		13.2767			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	100	>100			0.07796	0.08342	0.00304	0.00795	0.81883	4, 20

Dose-Response Plot



 ToxCalc v5.0 Reviewed by: MM

Bivalve Larval Survival and Development Test-Proportion Alive

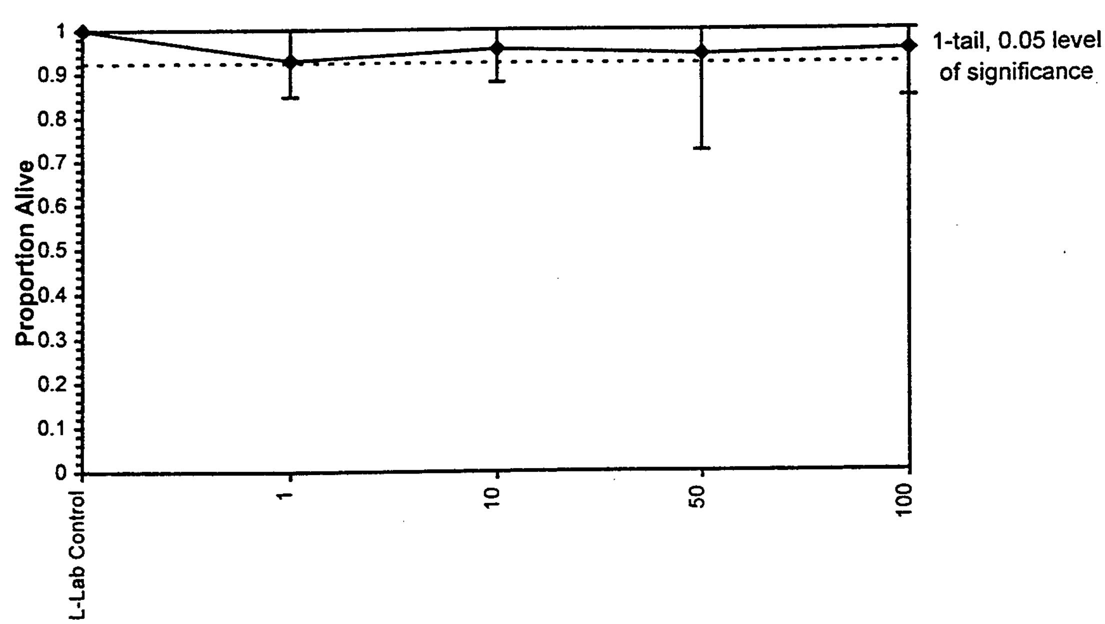
Start Date:	11/7/97	Test ID:	9711-012	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 1-2T				

Conc-	1	2	3	4	5
L-Lab Control	1.0000	1.0000	1.0000	1.0000	1.0000
1	0.9293	0.9293	1.0000	0.9375	0.8470
10	0.8799	1.0000	1.0000	0.8964	1.0000
50	1.0000	0.7237	0.9951	1.0000	1.0000
100	1.0000	0.9539	1.0000	0.8470	0.9704

			Transform: Arcsin Square Root						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
L-Lab Control	1.0000	1.0000	1.4269	1.4269	1.4269	0.000	5			
1	0.9286	0.9286	1.3034	1.1690	1.4269	7.026	5	1.656	2.300	0.1714
10	0.9553	0.9553	1.3482	1.2170	1.4269	8.029	5	1.057	2.300	0.1714
50	0.9438	0.9438	1.3597	1.0173	1.5005	14.271	5	0.902	2.300	0.1714
100	0.9543	0.9543	1.3550	1.1690	1.4269	7.982	5	0.964	2.300	0.1714

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)					0.83755		0.888		-1.6205	3.1948
Equality of variance cannot be confirmed										
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	100	>100			0.07562	0.07721	0.00979	0.01389	0.59796	4, 20

Dose-Response Plot



ToxCalc v5.0

Reviewed by: MA

Bivalve Larval Survival and Development Test-Proportion Normal

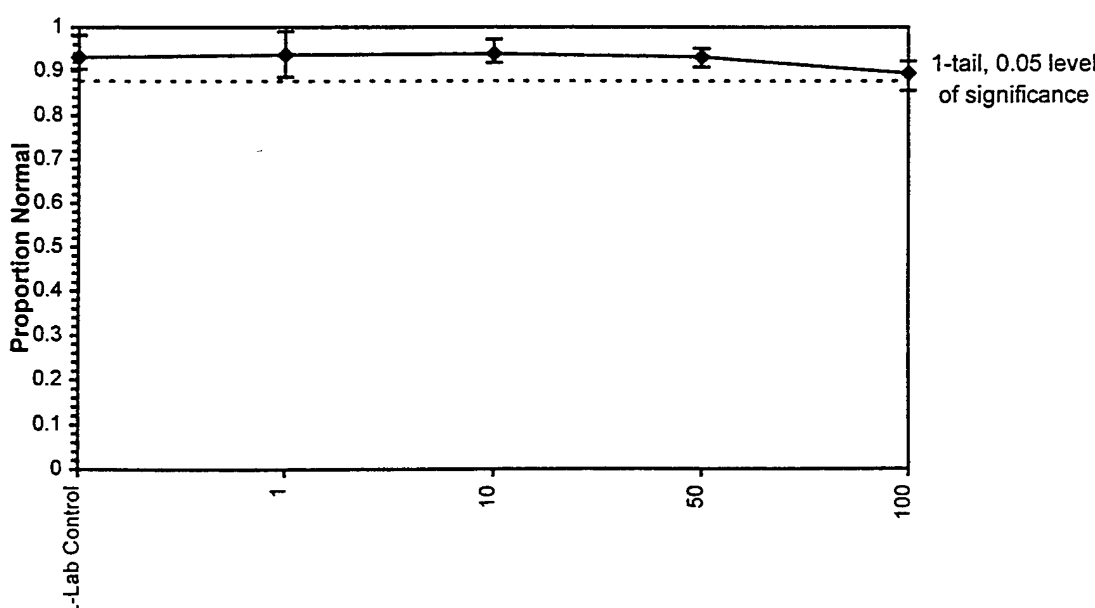
Start Date:	11/7/97	Test ID:	9711-012	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 1-2T				

Conc-	1	2	3	4	5
L-Lab Control	0.9138	0.9444	0.9817	0.9091	0.9040
1	0.9558	0.9204	0.9306	0.8860	0.9903
10	0.9720	0.9274	0.9191	0.9541	0.9214
50	0.9521	0.9091	0.9339	0.9338	0.9330
100	0.9091	0.9138	0.8718	0.9223	0.8559

			Transform: Arcsin Square Root						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
L-Lab Control	0.9306	1.0000	1.3122	1.2558	1.4349	5.715	5			
1	0.9366	1.0064	1.3292	1.2263	1.4721	6.986	5	-0.426	2.300	0.0921
10	0.9388	1.0088	1.3249	1.2824	1.4026	3.944	5	-0.318	2.300	0.0921
50	0.9324	1.0019	1.3090	1.2645	1.3502	2.318	5	0.080	2.300	0.0921
100	0.8946	0.9613	1.2424	1.1815	1.2884	3.747	5	1.743	2.300	0.0921

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.93425		0.888		0.80593	0.65323
Bartlett's Test indicates equal variances (p = 0.29)					4.9864		13.2767			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	100	>100			0.05267	0.05636	0.00621	0.00401	0.2271	4, 20

Dose-Response Plot



 ToxCalc v5.0 Reviewed by: ML

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID:	9711-013	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 1-2B				

Conc-	1	2	3	4	5
L-Lab Control	1.0000	1.0000	1.0000	1.0000	1.0000
1	0.7730	0.8882	0.7813	0.8717	0.6250
10	0.6003	1.0000	1.0000	0.9868	0.8635
50	0.6743	0.5674	0.7813	0.5345	0.8799
100	0.1563	0.2138	0.1151	0.1069	0.1809

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
L-Lab Control	1.0000	1.0000	1.4269	1.4269	1.4269	0.000	5				1	61
*1	0.7878	0.7878	1.1009	0.9117	1.2298	11.501	5	3.537	2.300	0.2120	12	61
10	0.8901	0.8901	1.2777	0.8864	1.4558	19.037	5	1.619	2.300	0.2120	7	61
*50	0.6875	0.6875	0.9875	0.8200	1.2170	16.694	5	4.766	2.300	0.2120	20	61
*100	0.1546	0.1546	0.4011	0.3331	0.4807	15.502	5	11.127	2.300	0.2120	52	61

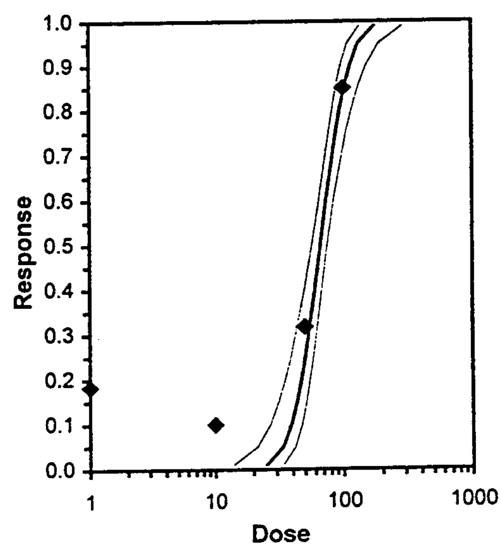
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94264	0.888	-0.8813	1.91313
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	10	50	22.3607		0.10086	0.10298	0.77599	0.02125	6.3E-09	4, 20

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	5.51623	0.99266	3.57062	7.46184	0.01316	4.95777	9.21035	0.08	1.82388	0.18128	11
Intercept	-5.0609	1.8486	-8.6842	-1.4377							
TSCR	0.10636	0.02279	0.06169	0.15103							

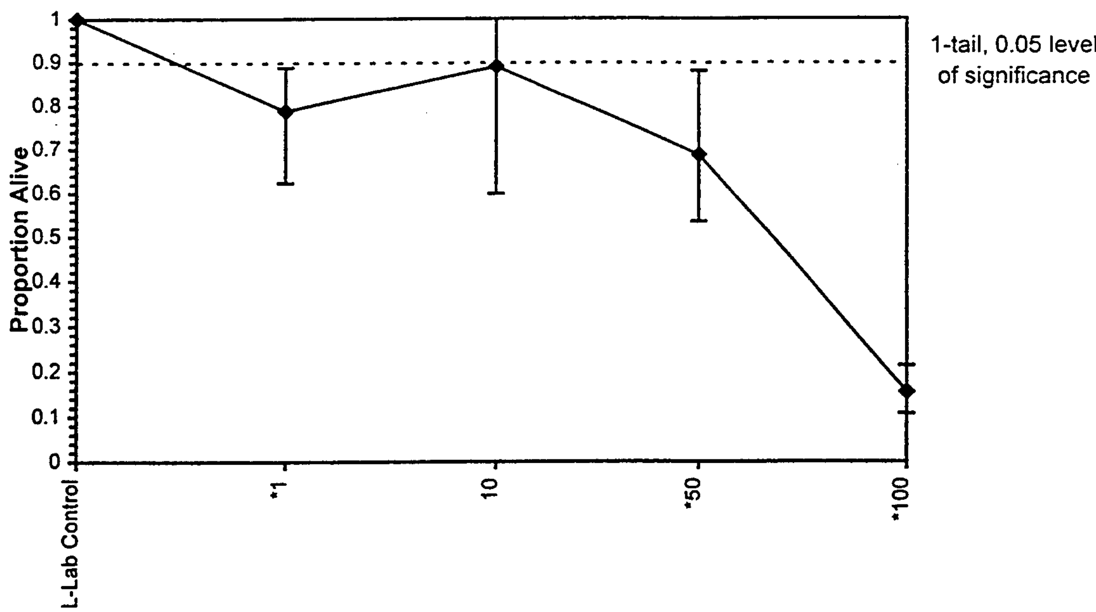
Point	Probits		95% Fiducial Limits	
EC01	2.674	25.2436	13.8984	33.9456
EC05	3.355	33.5502	21.4195	42.1825
EC10	3.718	39.0442	26.914	47.4678
EC15	3.964	43.2506	31.3474	51.4841
EC20	4.158	46.9146	35.3372	54.9934
EC25	4.326	50.3044	39.1078	58.2753
EC40	4.747	59.9725	50.0163	68.0804
EC50	5.000	66.6622	57.372	75.5683
EC60	5.253	74.0982	65.0161	84.9032
EC75	5.674	88.3392	77.8089	105.999
EC80	5.842	94.7222	82.9259	116.64
EC85	6.036	102.747	89.0019	130.86
EC90	6.282	113.816	96.9225	151.802
EC95	6.645	132.454	109.46	190.056
EC99	7.326	176.039	136.464	291.954



 ToxCalc v5.0 Reviewed by: MA

Bivalve Larval Survival and Development Test-Proportion Alive					
Start Date: 11/7/97		Test ID:	9711-013	Sample ID:	MEC-Homeporting Pearl Harbor
End Date: 11/9/97		Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 1-2B				

Dose-Response Plot



ToxCalc v5.0

Reviewed by: MH

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	11/7/97	Test ID:	9711-013	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 1-2B				

Conc-	1	2	3	4	5
L-Lab Control	0.9138	0.9444	0.9817	0.9091	0.9040
1	0.9681	0.9352	0.9684	0.8679	0.9211
10	0.9178	0.9139	0.9384	0.9083	0.9048
50	0.4024	0.6667	0.8000	0.6308	0.7103
100	0.0526	0.3077	0.1429	0.1538	0.1818

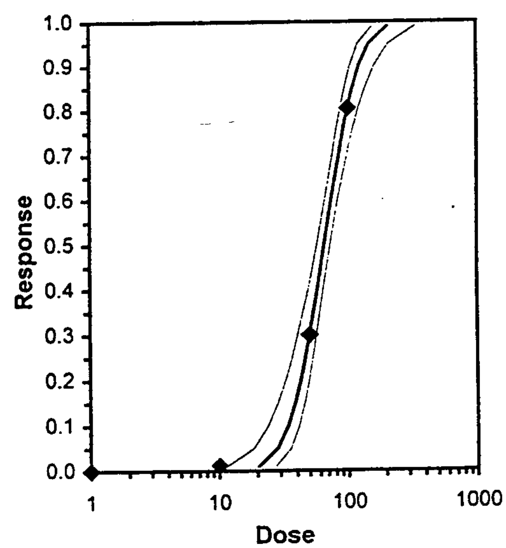
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
L-Lab Control	0.9306	1.0000	1.3122	1.2558	1.4349	5.715	5				43	608
1	0.9321	1.0017	1.3163	1.1989	1.3921	6.134	5	-0.063	2.300	0.1499	33	479
10	0.9166	0.9850	1.2786	1.2571	1.3199	1.931	5	0.515	2.300	0.1499	49	595
*50	0.6420	0.6899	0.9340	0.6872	1.1071	16.612	5	5.804	2.300	0.1499	146	418
*100	0.1678	0.1803	0.4101	0.2315	0.5880	31.090	5	13.842	2.300	0.1499	77	94

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.93934		0.888		-0.4782	1.47636
Bartlett's Test indicates equal variances (p = 0.04)					9.9468		13.2767			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	10	50	22.3607		0.09239	0.09886	0.76854	0.01062	1.3E-11	4, 20

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	4.60977	0.72483	3.1891	6.03044	0.07072	0.13892	9.21035	0.93	1.81353	0.21693	4
Intercept	-3.36	1.3433	-5.9928	-0.7271							
TSCR	0.07227	0.00918	0.05427	0.09026							

Point	Probits		95% Fiducial Limits	
EC01	2.674	20.3645	11.5389	27.6933
EC05	3.355	28.6228	18.7742	36.1146
EC10	3.718	34.3181	24.2921	41.6815
EC15	3.964	38.7879	28.8656	45.9764
EC20	4.158	42.7521	33.0663	49.7648
EC25	4.326	46.4743	37.1058	53.3319
EC40	4.747	57.355	49.135	64.1108
EC50	5.000	65.0924	57.4702	72.4991
EC60	5.253	73.8736	66.2356	83.2025
EC75	5.674	91.1691	81.1928	108.045
EC80	5.842	99.1068	87.3644	120.756
EC85	6.036	109.236	94.8633	137.891
EC90	6.282	123.463	104.905	163.435
EC95	6.645	148.03	121.34	211.01
EC99	7.326	208.059	158.537	342.673

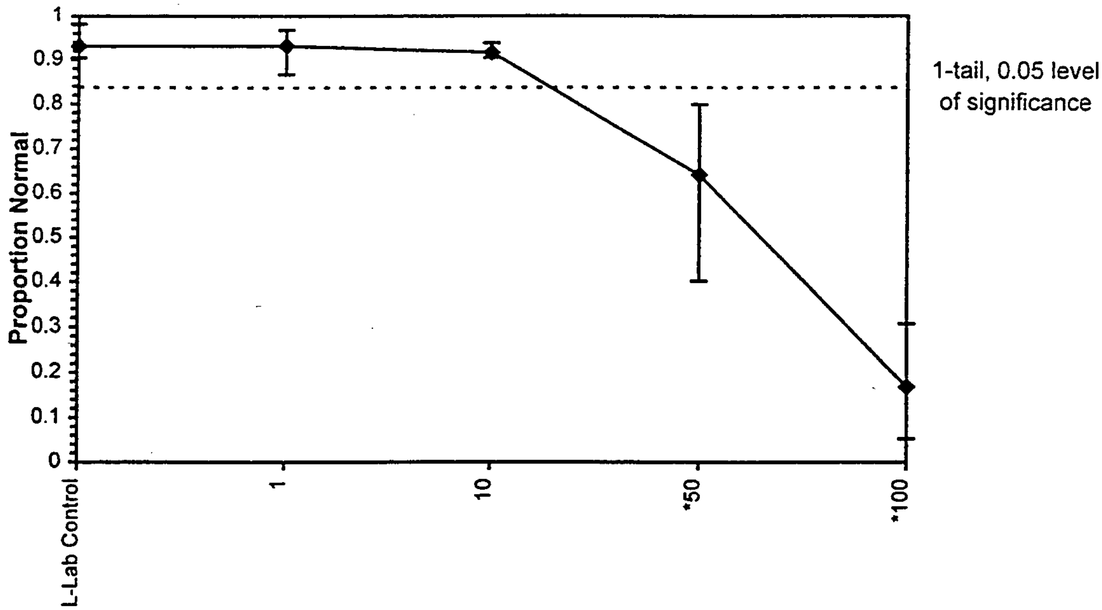


ToxCalc v5.0

Reviewed by: ____

Bivalve Larval Survival and Development Test-Proportion Normal					
Start Date:	11/7/97	Test ID: 9711-013		Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID: CAOEE-Ogden Bioassay		Sample Type:	SED-Marine Sediments
Sample Date:		Protocol: ASTM 87		Test Species:	CG-Crassostrea gigas
Comments:	Site: 1-2B				

Dose-Response Plot



 ToxCalc v5.0 Reviewed by: *MG*

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID:	9711-014	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 3				

Conc-	1	2	3	4	5
L-Lab Control	1.0000	1.0000	1.0000	1.0000	1.0000
1	1.0000	1.0000	1.0000	0.8553	0.9046
10	0.9046	1.0000	0.9375	0.9375	0.6003
50	0.8553	0.9211	0.8470	0.6990	0.8799
100	0.2549	0.2303	0.1151	0.2467	0.1891

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
L-Lab Control	1.0000	1.0000	1.4269	1.4269	1.4269	0.000	5				1	61
1	0.9520	0.9520	1.3436	1.1805	1.4269	8.724	5	1.079	2.300	0.1776	4	61
*10	0.8760	0.8760	1.2413	0.8864	1.4269	16.727	5	2.404	2.300	0.1776	9	61
*50	0.8405	0.8405	1.1685	0.9901	1.2860	9.387	5	3.346	2.300	0.1776	10	61
*100	0.2072	0.2072	0.4691	0.3462	0.5293	16.041	5	12.403	2.300	0.1776	49	61

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.8686	0.888	-1.5066	3.34073
Equality of variance cannot be confirmed				

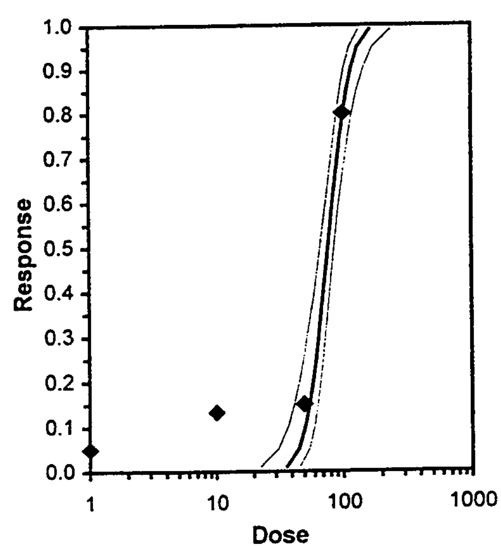
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	1	10	3.16228		0.07929	0.08095	0.73049	0.01491	4.7E-10	4, 20

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits	
Slope	7.09805	1.27549	4.59809	9.59801
Intercept	-8.4044	2.45528	-13.217	-3.5921
TSCR	0.07893	0.01993	0.03987	0.11799

Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
0.01316	3.64026	9.21035	0.16	1.88847	0.14088	10

Point	Probits		95% Fiducial Limits	
EC01	2.674	36.3684	22.486	46.2341
EC05	3.355	45.3666	31.4422	54.7744
EC10	3.718	51.041	37.5275	60.0626
EC15	3.964	55.2653	42.2336	63.9945
EC20	4.158	58.8706	46.3429	67.3726
EC25	4.326	62.1505	50.1345	70.4841
EC40	4.747	71.2487	60.7214	79.4978
EC50	5.000	77.3516	67.6497	86.0844
EC60	5.253	83.9773	74.7631	93.9718
EC75	5.674	96.2707	86.4978	110.955
EC80	5.842	101.634	91.0894	119.247
EC85	6.036	108.264	96.444	130.108
EC90	6.282	117.225	103.268	145.7
EC95	6.645	131.887	113.756	173.107
EC99	7.326	164.518	135.338	241.039



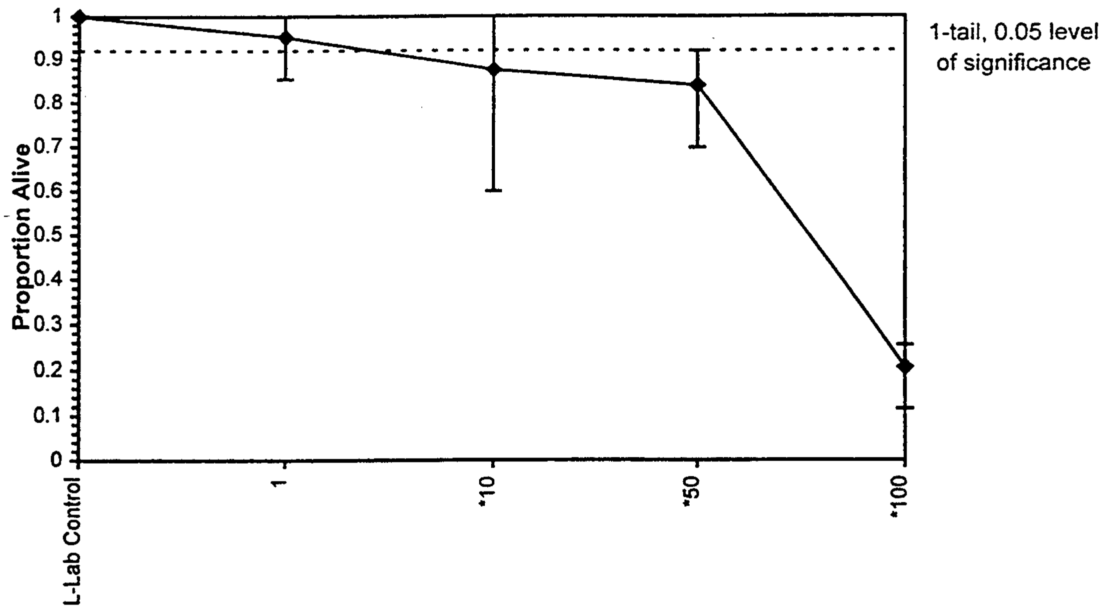
ToxCalc v5.0

Reviewed by: _Ml_

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID:	9711-014	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 3				

Dose-Response Plot



ToxCalc v5.0

Reviewed by: *[signature]*

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	11/7/97	Test ID:	9711-014	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 3				

Conc-	1	2	3	4	5
L-Lab Control	0.9138	0.9444	0.9817	0.9091	0.9040
1	0.7857	0.7967	0.8540	0.8750	0.8364
10	0.8364	0.8544	0.9035	0.9298	0.8493
50	0.8462	0.7679	0.7670	0.7176	0.7196
100	0.2903	0.3214	0.0000	0.0667	0.0870

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
L-Lab Control	0.9306	1.0000	1.3122	1.2558	1.4349	5.715	5				43	608
*1	0.8296	0.8914	1.1470	1.0895	1.2094	4.400	5	2.428	2.300	0.1564	122	717
10	0.8747	0.9399	1.2127	1.1543	1.3027	5.224	5	1.463	2.300	0.1564	78	617
*50	0.7637	0.8206	1.0652	1.0106	1.1677	5.985	5	3.631	2.300	0.1564	120	511
*100	0.1531	0.1645	0.3733	0.1340	0.6028	54.621	5	13.805	2.300	0.1564	104	126

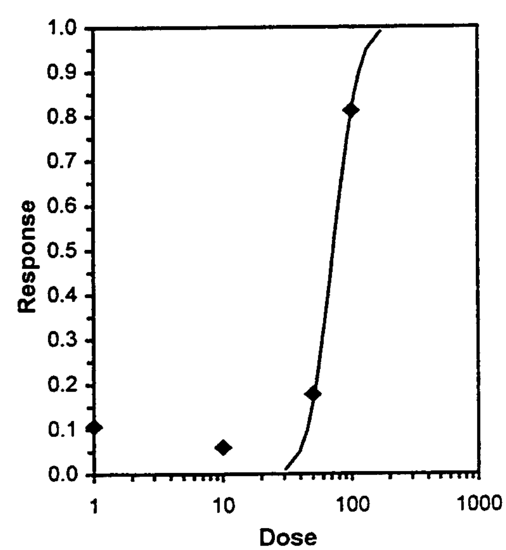
Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.93644		0.888		0.3289	1.30853
Bartlett's Test indicates equal variances (p = 0.03)					11.1205		13.2767			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	10	50	22.3607		0.09719	0.10399	0.69863	0.01156	7.0E-11	4, 20

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	6.24377	1.68868	-1.022	13.5096	0.07072	10.3665	9.21035	5.6E-03	1.86093	0.16016	7
Intercept	-6.6192	3.1938	-20.361	7.12265							
TSCR	0.09345	0.0226	-0.0038	0.19068							

Point	Probits		95% Fiducial Limits
EC01	2.674	30.7849	
EC05	3.355	39.581	
EC10	3.718	45.2556	
EC15	3.964	49.5371	
EC20	4.158	53.227	
EC25	4.326	56.6108	
EC40	4.747	66.1226	
EC50	5.000	72.5982	
EC60	5.253	79.708	
EC75	5.674	93.1005	
EC80	5.842	99.0192	
EC85	6.036	106.395	
EC90	6.282	116.461	
EC95	6.645	133.157	
EC99	7.326	171.204	

Significant heterogeneity detected (p = 5.61E-03)



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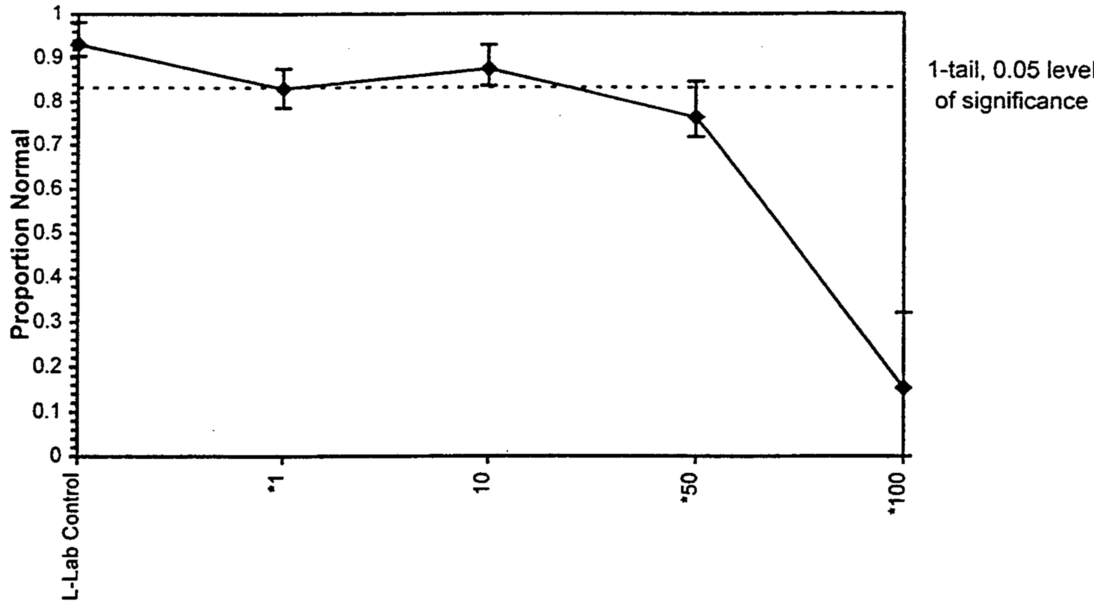
Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	11/7/97	Test ID:	9711-014	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 3				

Dose-Response Plot



ToxCalc v5.0

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Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID:	9711-015	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 4				

Conc-	1	2	3	4	5
L-Lab Control	1.0000	1.0000	1.0000	1.0000	1.0000
1	1.0000	0.6414	0.6332	0.7237	0.6579
10	0.6826	0.7484	0.8388	0.7895	0.9539
50	1.0000	0.6086	0.6661	0.7237	0.5674
100	0.3289	0.3207	0.3783	0.4276	0.3536

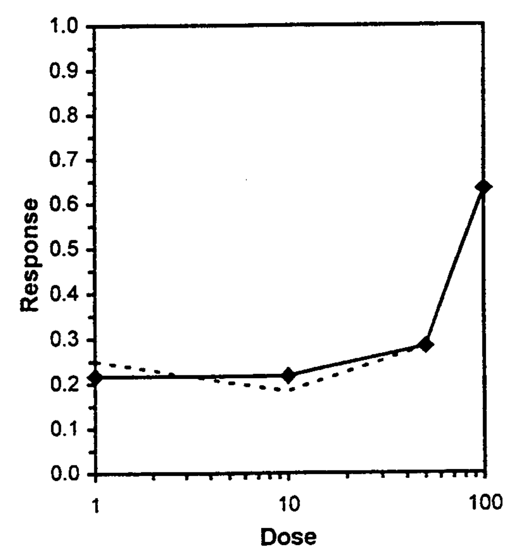
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
L-Lab Control	1.0000	1.0000	1.4269	1.4269	1.4269	0.000	5				1	61
*1	0.7313	0.7313	1.0479	0.9203	1.4269	20.548	5	3.826	2.300	0.2279	16	61
*10	0.8026	0.8026	1.1248	0.9723	1.3545	12.912	5	3.050	2.300	0.2279	12	61
*50	0.7132	0.7132	1.0294	0.8530	1.4269	22.415	5	4.013	2.300	0.2279	18	61
*100	0.3618	0.3618	0.6450	0.6020	0.7128	6.924	5	7.893	2.300	0.2279	39	61

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.79462	0.888	1.74085	3.10312
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	<1	1			0.11138	0.11372	0.39001	0.02454	5.3E-06	4, 20

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%			
5.0%			
10.0%			
20.0%			
Auto-36.7%	76.793	73.743	79.970



ToxCalc v5.0

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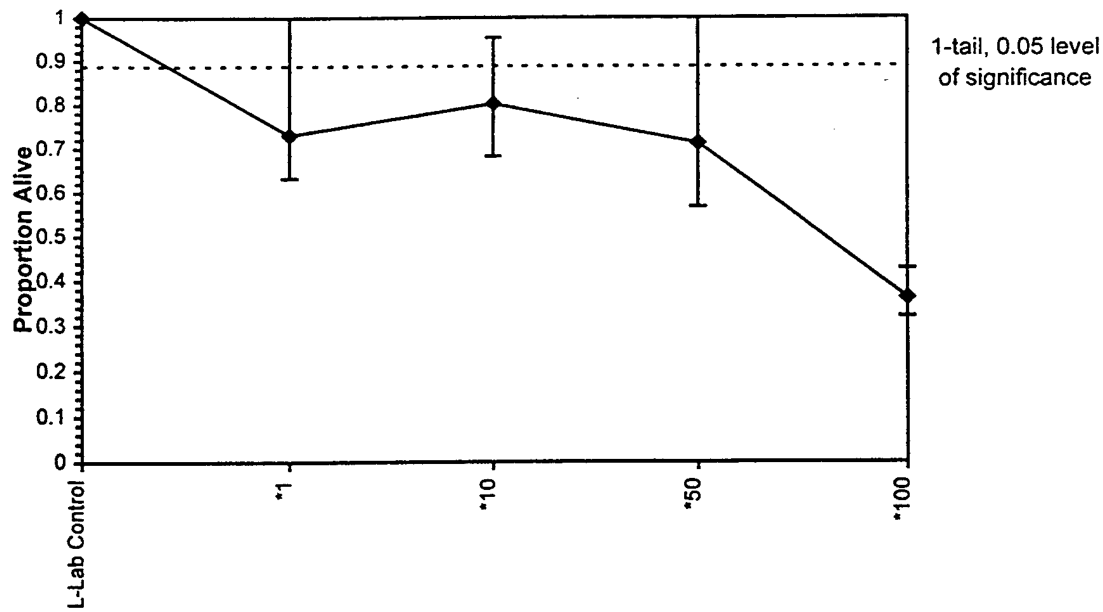
Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID:	9711-015	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 4				

Dose-Response Plot



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Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	11/7/97	Test ID:	9711-015	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 4				

Conc-	1	2	3	4	5
L-Lab Control	0.9138	0.9444	0.9817	0.9091	0.9040
1	0.8367	0.9231	0.7922	0.8864	0.8500
10	0.8434	0.9011	0.8627	0.8333	0.8103
50	0.6786	0.5270	0.5926	0.6250	0.4928
100	0.1000	0.5641	0.0000	0.1538	0.0233

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
L-Lab Control	0.9306	1.0000	1.3122	1.2558	1.4349	5.715	5				43	608
1	0.8577	0.9216	1.1884	1.0975	1.2898	6.153	5	1.312	2.300	0.2169	68	470
10	0.8502	0.9136	1.1753	1.1202	1.2509	4.203	5	1.451	2.300	0.2169	74	488
*50	0.5832	0.6267	0.8698	0.7782	0.9680	8.750	5	4.691	2.300	0.2169	181	452
*100	0.1682	0.1808	0.3603	0.0738	0.8497	84.170	5	10.094	2.300	0.2169	185	220

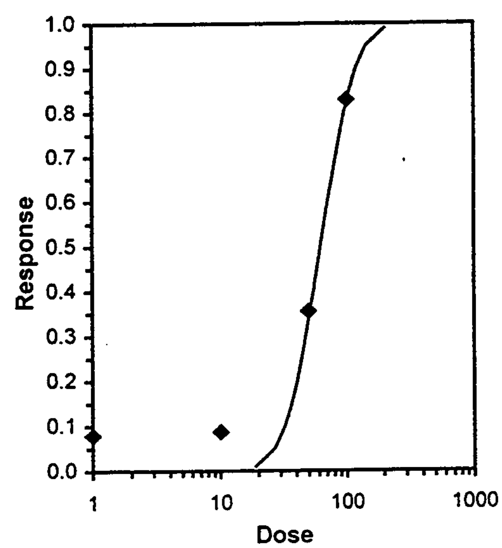
Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)					0.8298		0.888		1.56189	6.96961
Bartlett's Test indicates unequal variances (p = 1.27E-03)					17.9428		13.2767			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	10	50	22.3607		0.14417	0.15426	0.73516	0.02223	1.5E-08	4, 20

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	4.50848	1.073	-0.1083	9.12524	0.07072	9.64755	9.21035	8.0E-03	1.79514	0.2218	9
Intercept	-3.0933	1.98465	-11.633	5.44591							
TSCR	0.10316	0.02065	0.0143	0.19202							

Point	Probits		95% Fiducial Limits
EC01	2.674	19.017	
EC05	3.355	26.9339	
EC10	3.718	32.4251	
EC15	3.964	36.7494	
EC20	4.158	40.5938	
EC25	4.326	44.211	
EC40	4.747	54.8203	
EC50	5.000	62.3929	
EC60	5.253	71.0115	
EC75	5.674	88.0521	
EC80	5.842	95.8982	
EC85	6.036	105.93	
EC90	6.282	120.057	
EC95	6.645	144.534	
EC99	7.326	204.705	

Significant heterogeneity detected (p = 8.04E-03)



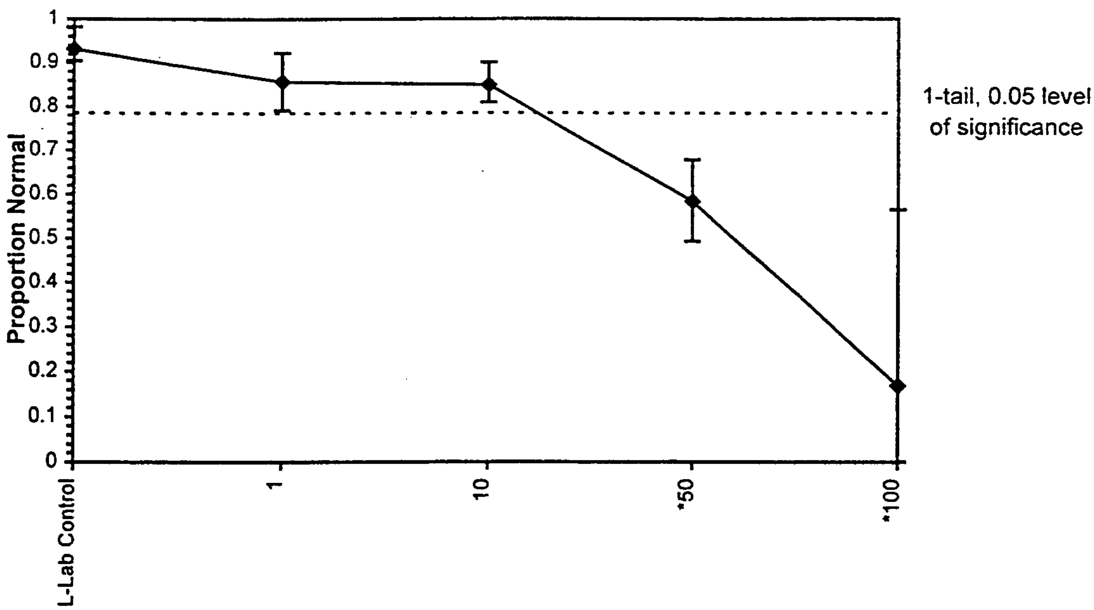
ToxCalc v5.0

Reviewed by: MA

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	11/7/97	Test ID:	9711-015	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 4				

Dose-Response Plot



ToxCalc v5.0

Reviewed by: MG

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID:	9711-016	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 5				

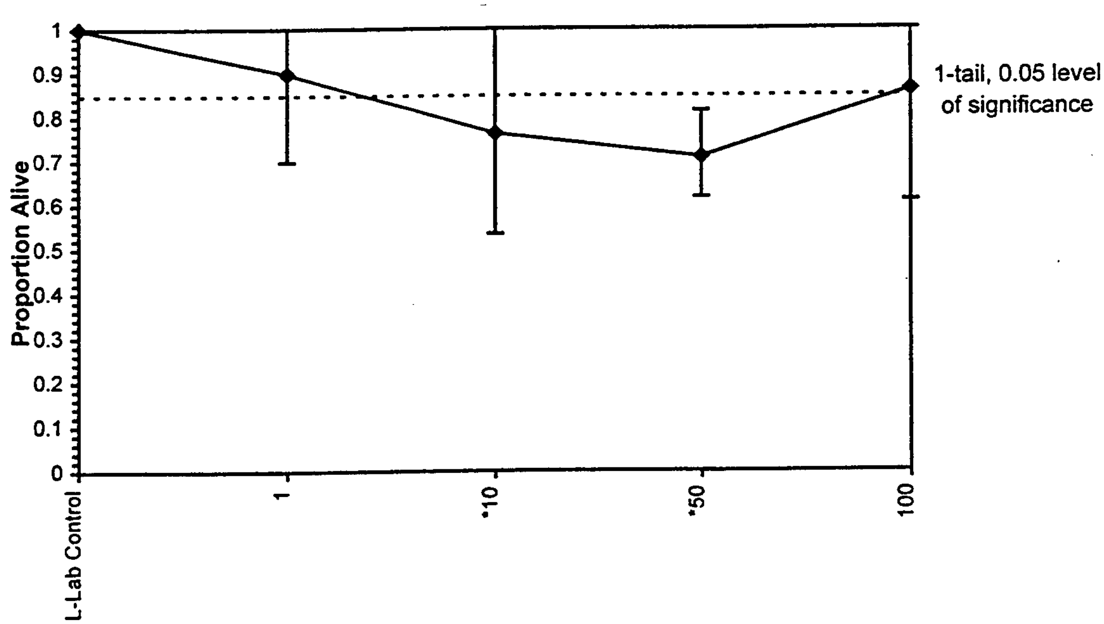
Conc-	1	2	3	4	5
L-Lab Control	1.0000	1.0000	1.0000	1.0000	1.0000
1	1.0000	0.9951	1.0000	0.7977	0.6990
10	0.9539	0.5345	1.0000	0.7895	0.5345
50	0.6168	0.7484	0.6743	0.8141	0.6908
100	0.8306	1.0000	0.8635	0.6086	1.0000

			Transform: Arcsin Square Root					1-Tailed		
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
L-Lab Control	1.0000	1.0000	1.4269	1.4269	1.4269	0.000	5			
1	0.8984	0.8984	1.2897	0.9901	1.5005	17.606	5	1.112	2.300	0.2837
*10	0.7625	0.7625	1.1031	0.8200	1.4269	25.978	5	2.625	2.300	0.2837
*50	0.7089	0.7089	1.0037	0.9033	1.1251	8.436	5	3.431	2.300	0.2837
100	0.8605	0.8605	1.2175	0.8948	1.4269	18.250	5	1.697	2.300	0.2837

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.9441	0.888	-0.2338	-0.4963
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	>100			0.15141	0.15459	0.13432	0.03804	0.02459	4, 20

Dose-Response Plot



ToxCalc v5.0

Reviewed by: Mh

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	11/7/97	Test ID:	9711-016	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 5				

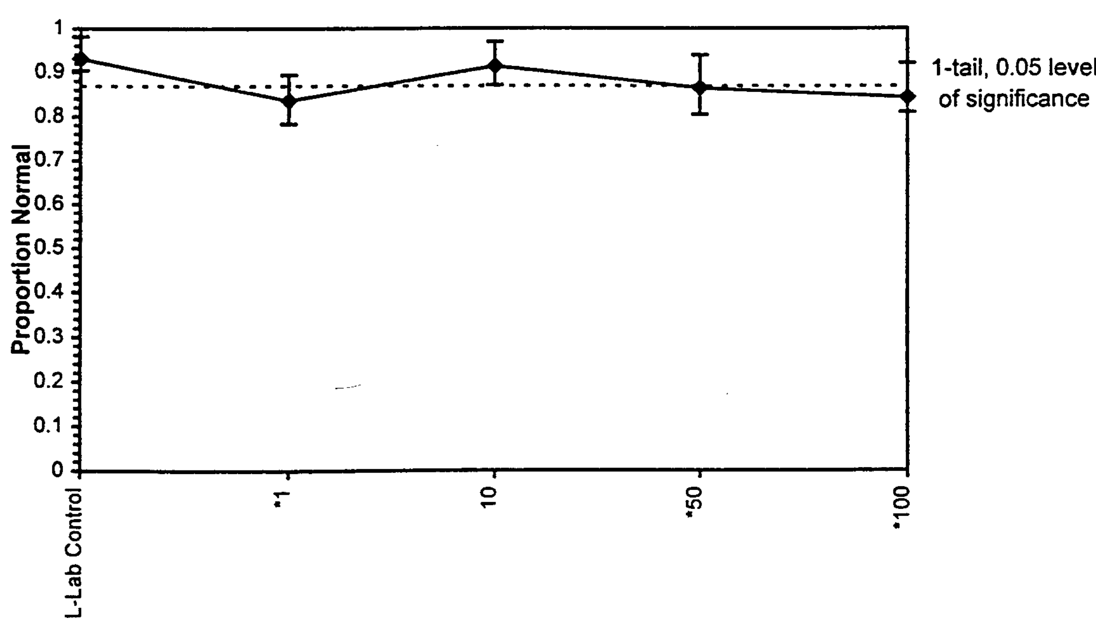
Conc-	1	2	3	4	5
L-Lab Control	0.9138	0.9444	0.9817	0.9091	0.9040
1	0.8792	0.8182	0.8033	0.7835	0.8941
10	0.9310	0.9692	0.8702	0.9063	0.8923
50	0.8267	0.8791	0.8049	0.9394	0.8690
100	0.8317	0.9220	0.8286	0.8108	0.8244

			Transform: Arcsin Square Root						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
L-Lab Control	0.9306	1.0000	1.3122	1.2558	1.4349	5.715	5			
*1	0.8357	0.8980	1.1567	1.0868	1.2394	5.795	5	3.360	2.300	0.1064
10	0.9138	0.9820	1.2796	1.2023	1.3945	5.807	5	0.705	2.300	0.1064
*50	0.8638	0.9282	1.1986	1.1133	1.3221	6.738	5	2.455	2.300	0.1064
*100	0.8435	0.9064	1.1678	1.1208	1.2877	5.810	5	3.120	2.300	0.1064

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.87185	0.888	0.8307	-0.5758
Bartlett's Test indicates equal variances (p = 1.00)	0.17428	13.2767		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	10	50	22.3607		0.06204	0.06638	0.02399	0.00535	0.00953	4, 20

Dose-Response Plot



ToxCalc v5.0
Reviewed by: MA

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID:	9711-017	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 6				

Conc-	1	2	3	4	5
L-Lab Control	1.0000	1.0000	1.0000	1.0000	1.0000
1	1.0000	0.7895	1.0000	1.0000	0.8964
10	0.9539	0.8224	1.0000	0.6743	0.7648
50	1.0000	0.8882	0.9951	0.7648	1.0000
100	0.2467	0.2385	0.2796	0.5181	0.4441

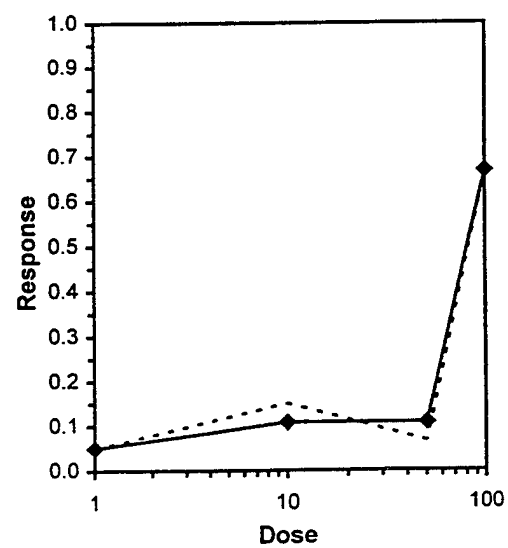
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
L-Lab Control	1.0000	1.0000	1.4269	1.4269	1.4269	0.000	5				1	61
1	0.9372	0.9372	1.3236	1.0941	1.4269	11.406	5	1.096	2.300	0.2168	4	61
*10	0.8431	0.8431	1.1890	0.9635	1.4269	16.459	5	2.523	2.300	0.2168	10	61
50	0.9296	0.9296	1.3297	1.0645	1.5005	13.474	5	1.031	2.300	0.2168	5	61
*100	0.3454	0.3454	0.6240	0.5102	0.8035	21.440	5	8.517	2.300	0.2168	41	61

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.95768	0.888	-0.2454	-0.6841
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	50	100	70.7107		0.10401	0.10619	0.51651	0.02222	2.8E-07	4, 20

Trimmed Spearman-Karber

Trim Level	EC50	95% CL	
0.0%			
5.0%			
10.0%			
20.0%			
Auto-33.3%	81.309	79.252	83.420



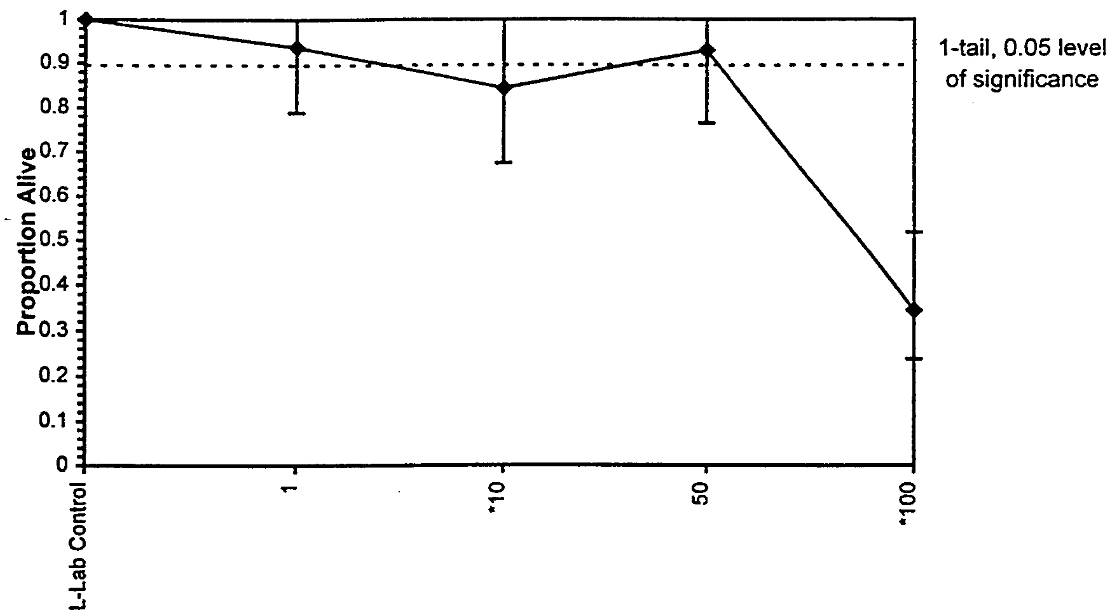
ToxCalc v5.0

Reviewed by: MH

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID: 9711-017		Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID: CAOEE-Ogden Bioassay		Sample Type:	SED-Marine Sediments
Sample Date:		Protocol: ASTM 87		Test Species:	CG-Crassostrea gigas
Comments:	Site: 6				

Dose-Response Plot



ToxCalc v5.0

Reviewed by: ML

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	11/7/97	Test ID:	9711-017	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 6				

Conc-	1	2	3	4	5
L-Lab Control	0.9138	0.9444	0.9817	0.9091	0.9040
1	0.8092	0.9063	0.8730	0.8625	0.7890
10	0.8621	0.9200	0.9030	0.8293	0.8387
50	0.8527	0.7593	0.7769	0.8065	0.8533
100	0.0667	0.2414	0.0294	0.1270	0.0370

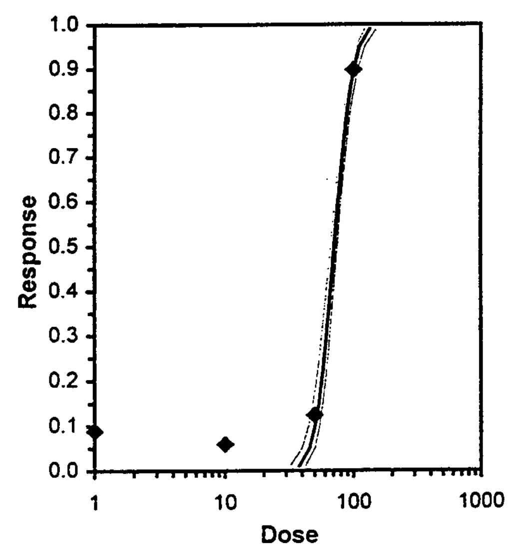
			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
L-Lab Control	0.9306	1.0000	1.3122	1.2558	1.4349	5.715	5				43	608
*1	0.8480	0.9112	1.1738	1.0935	1.2596	5.747	5	2.556	2.300	0.1245	95	622
10	0.8706	0.9355	1.2061	1.1448	1.2840	5.032	5	1.959	2.300	0.1245	66	525
*50	0.8097	0.8701	1.1213	1.0580	1.1778	4.912	5	3.526	2.300	0.1245	112	601
*100	0.1003	0.1078	0.3010	0.1724	0.5136	46.647	5	18.684	2.300	0.1245	190	210

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.94932		0.888		0.77674	0.78167
Bartlett's Test indicates equal variances (p = 0.31)					4.78748		13.2767			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	10	50	22.3607		0.07431	0.07951	0.83855	0.00732	1.7E-13	4, 20

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	8.46197	0.7242	7.04254	9.8814	0.07072	8.61022	9.21035	0.01	1.85229	0.11818	7
Intercept	-10.674	1.37922	-13.377	-7.9708							
TSCR	0.09871	0.0093	0.08048	0.11694							

Point	Probits		95% Fiducial Limits	
EC01	2.674	37.7898	32.0802	42.6075
EC05	3.355	45.4894	39.9572	50.103
EC10	3.718	50.2162	44.8821	54.6687
EC15	3.964	53.6798	48.5187	58.0116
EC20	4.158	56.6022	51.5971	60.8381
EC25	4.326	59.2358	54.3735	63.3956
EC40	4.747	66.4283	61.9202	70.4747
EC50	5.000	71.1693	66.8203	75.261
EC60	5.253	76.2486	71.9593	80.5386
EC75	5.674	85.5068	80.9516	90.6327
EC80	5.842	89.4853	84.6645	95.1601
EC85	6.036	94.3569	89.1015	100.843
EC90	6.282	100.865	94.8719	108.644
EC95	6.645	111.346	103.878	121.612
EC99	7.326	134.033	122.589	150.932



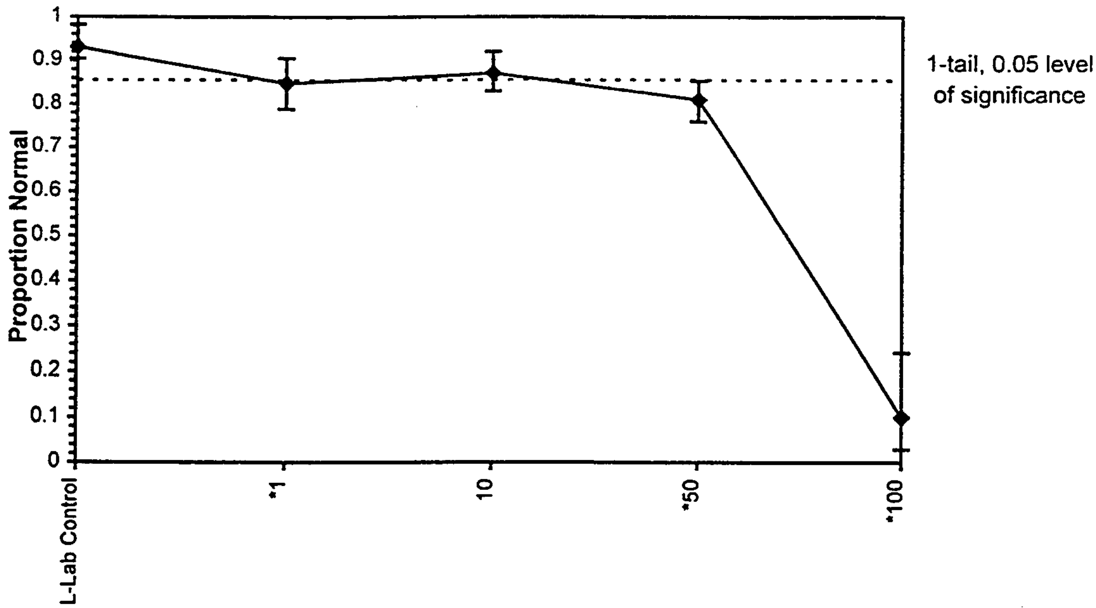
ToxCalc v5.0

Reviewed by: MH

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	11/7/97	Test ID:	9711-017	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 6				

Dose-Response Plot



 ToxCalc v5.0 Reviewed by: ________

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID:	9711-018	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 7				

Conc-	1	2	3	4	5
L-Lab Control	1.0000	1.0000	1.0000	1.0000	1.0000
1	0.9622	1.0000	0.8717	0.9539	0.6003
10	0.8553	0.7730	0.4852	0.5428	0.7401
50	0.6826	0.5839	0.9375	0.5345	0.6086
100	0.4934	0.2549	0.3618	0.5839	0.2632

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
L-Lab Control	1.0000	1.0000	1.4269	1.4269	1.4269	0.000	5				1	61
1	0.8776	0.8776	1.2495	0.8864	1.4269	17.540	5	1.677	2.300	0.2434	7	61
*10	0.6793	0.6793	0.9779	0.7706	1.1805	17.644	5	4.244	2.300	0.2434	20	61
*50	0.6694	0.6694	0.9750	0.8200	1.3181	20.468	5	4.271	2.300	0.2434	22	61
*100	0.3914	0.3914	0.6724	0.5293	0.8697	22.227	5	7.131	2.300	0.2434	38	61

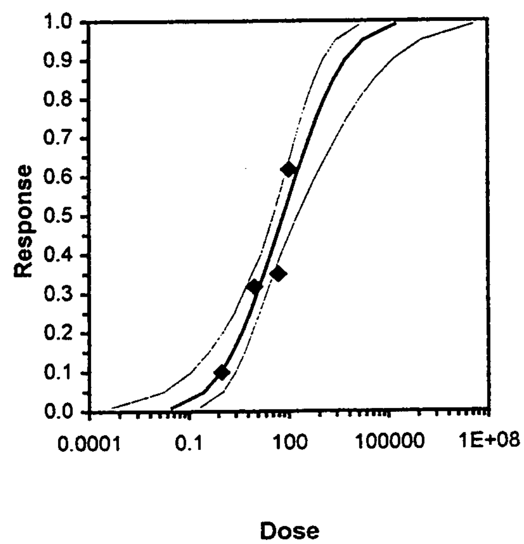
Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.98214	0.888	-0.0449	0.50608
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	1	10	3.16228		0.12206	0.12462	0.41844	0.02799	8.3E-06	4, 20

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	0.68871	0.13357	0.42691	0.95051	0.01316	4.58808	9.21035	0.1	1.84563	1.452	3
Intercept	3.7289	0.20426	3.32855	4.12925							
TSCR	0.01327	0.01462	-0.0154	0.04193							

Point	Probits		95% Fiducial Limits	
EC01	2.674	0.02936	0.00043	0.20327
EC05	3.355	0.28662	0.01646	1.09733
EC10	3.718	0.96565	0.1126	2.74494
EC15	3.964	2.19145	0.40504	5.18358
EC20	4.158	4.20338	1.09822	8.76459
EC25	4.326	7.34975	2.51716	14.1201
EC40	4.747	30.0449	15.8543	60.2797
EC50	5.000	70.0857	37.2919	185.648
EC60	5.253	163.489	77.5179	646.98
EC75	5.674	668.322	234.988	5738.73
EC80	5.842	1168.58	359.215	13862.3
EC85	6.036	2241.44	585.806	38969.7
EC90	6.282	5086.71	1077.88	143868
EC95	6.645	17137.6	2642.44	1004058
EC99	7.326	167293	14037.6	3.9E+07



 ToxCalc v5.0 Reviewed by: MLJ

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	11/7/97	Test ID:	9711-018	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 7				

Conc-	1	2	3	4	5
L-Lab Control	0.9138	0.9444	0.9817	0.9091	0.9040
1	0.8632	0.8248	0.8396	0.8534	0.8493
10	0.8750	0.8830	0.8475	0.7424	0.8333
50	0.6627	0.7606	0.8509	0.7538	0.8108
100	0.0000	0.1290	0.0682	0.1408	0.2813

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
L-Lab Control	0.9306	1.0000	1.3122	1.2558	1.4349	5.715	5				43	608
1	0.8461	0.9092	1.1680	1.1390	1.1920	1.724	5	2.253	2.300	0.1472	85	549
*10	0.8362	0.8986	1.1579	1.0385	1.2217	6.283	5	2.410	2.300	0.1472	65	413
*50	0.7677	0.8250	1.0715	0.9511	1.1743	7.815	5	3.760	2.300	0.1472	92	407
*100	0.1239	0.1331	0.3280	0.0646	0.5590	55.300	5	15.373	2.300	0.1472	212	238

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.94376	0.888	-0.3622	2.81855
Bartlett's Test indicates unequal variances (p = 9.21E-03)	13.4655	13.2767		

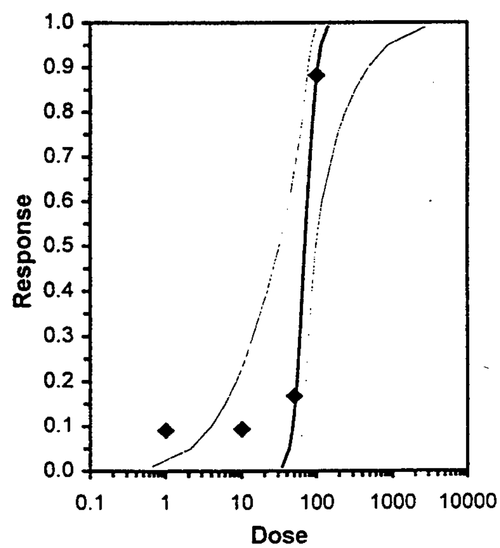
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	1	10	3.16228		0.09047	0.0968	0.75878	0.01025	1.1E-11	4, 20

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	7.57059	1.45749	1.2995	13.8417	0.07072	11.3201	9.21035	3.5E-03	1.84643	0.13209	7
Intercept	-8.9786	2.75577	-20.836	2.87851							
TSCR	0.10822	0.02245	0.01163	0.2048							

Point	Probits		95% Fiducial Limits	
EC01	2.674	34.6057	0.65048	52.9527
EC05	3.355	42.5761	2.13507	60.4464
EC10	3.718	47.5505	3.9993	65.2553
EC15	3.964	51.231	6.08187	69.0074
EC20	4.158	54.3582	8.45421	72.4181
EC25	4.326	57.1928	11.1707	75.7749
EC40	4.747	65.0085	21.9038	87.4163
EC50	5.000	70.2158	31.6062	98.9919
EC60	5.253	75.8402	43.1283	118.541
EC75	5.674	86.2042	60.9832	189.638
EC80	5.842	90.6995	66.5802	240.147
EC85	6.036	96.236	72.1969	323.066
EC90	6.282	103.685	78.3296	478.869
EC95	6.645	115.799	86.3776	878.13
EC99	7.326	142.47	100.374	2831.39

Significant heterogeneity detected (p = 3.48E-03)



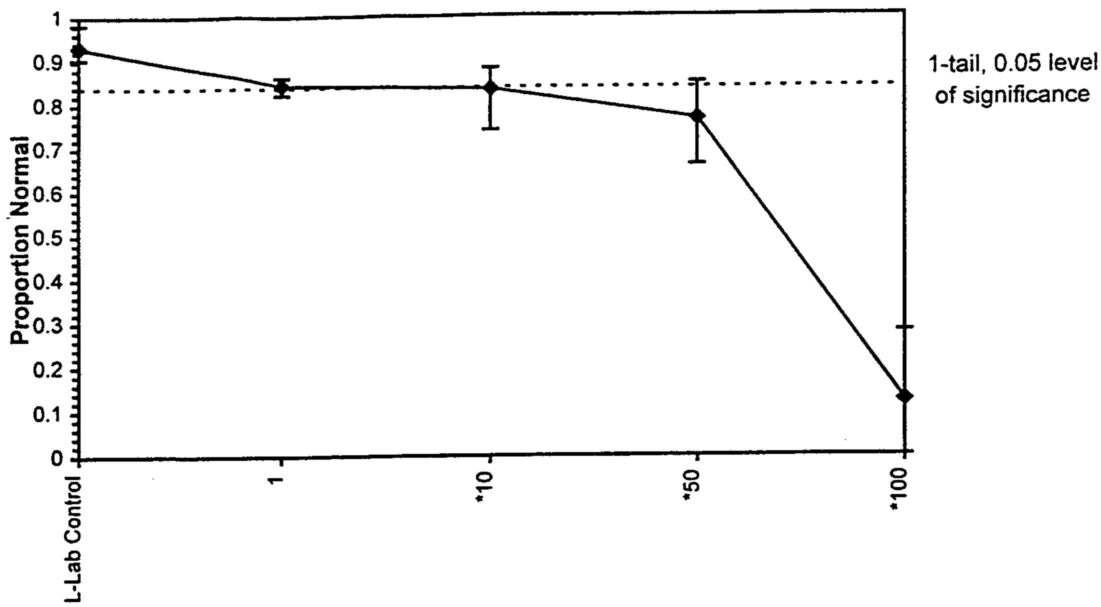
ToxCalc v5.0

Reviewed by: Mh

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	11/7/97	Test ID:	9711-018	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 7				

Dose-Response Plot



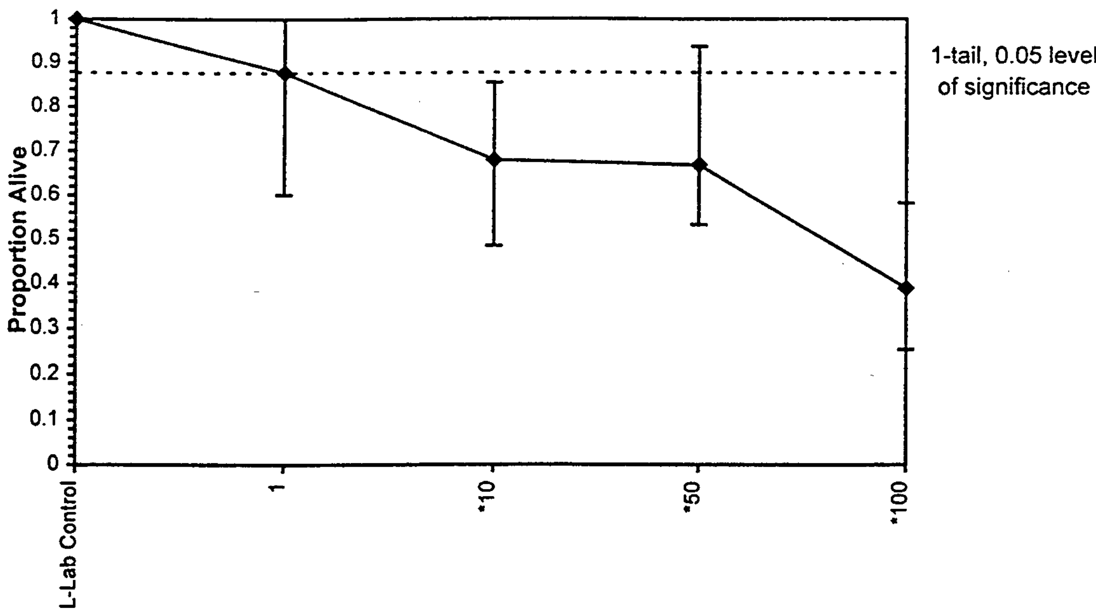
ToxCalc v5.0

Reviewed by: _/l/l/_

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID:	9711-018	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 7				

Dose-Response Plot



ToxCalc v5.0

Reviewed by: MH

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID:	9711-019	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 8				

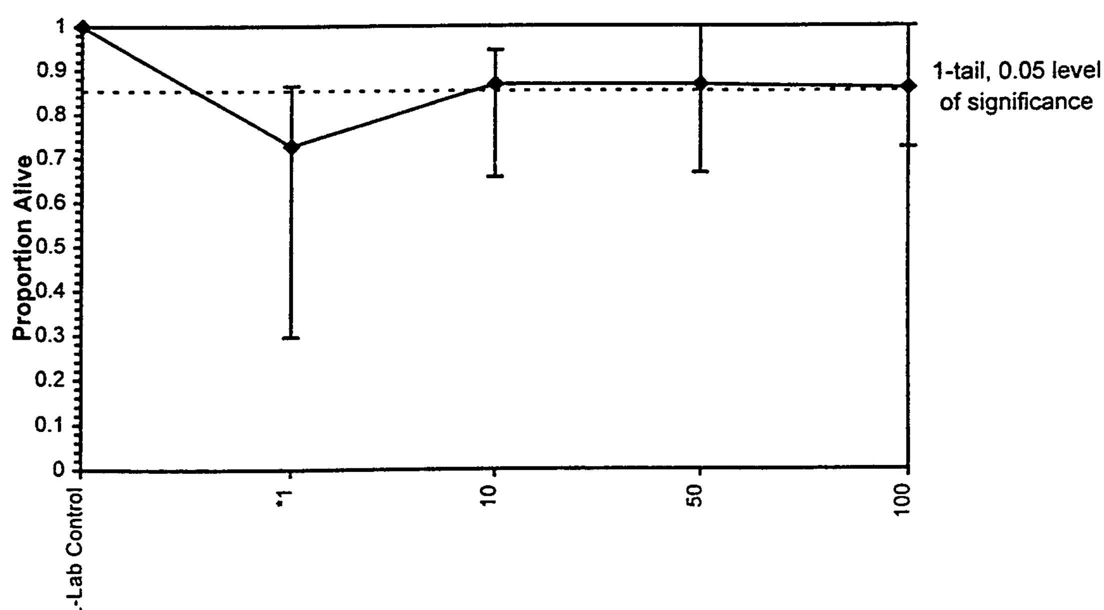
Conc-	1	2	3	4	5
L-Lab Control	1.0000	1.0000	1.0000	1.0000	1.0000
1	0.7977	0.8635	0.2961	0.8388	0.8388
10	0.6579	0.8799	0.9293	0.9457	0.9293
50	0.6661	0.7401	0.9293	1.0000	1.0000
100	0.7977	1.0000	0.7730	1.0000	0.7237

			Transform: Arcsin Square Root						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
L-Lab Control	1.0000	1.0000	1.4269	1.4269	1.4269	0.000	5			
*1	0.7270	0.7270	1.0375	0.5753	1.1924	25.086	5	3.224	2.300	0.2778
10	0.8684	0.8684	1.2204	0.9460	1.3357	13.070	5	1.710	2.300	0.2778
50	0.8671	0.8671	1.2292	0.9547	1.4269	18.014	5	1.637	2.300	0.2778
100	0.8589	0.8589	1.2099	1.0173	1.4269	16.574	5	1.796	2.300	0.2778

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.91494	0.888	-0.9544	0.57945
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	>100			0.147	0.15008	0.09526	0.03648	0.06633	4, 20

Dose-Response Plot



ToxCalc v5.0

Reviewed by: AM

Bivalve Larval Survival and Development Test-Proportion Normal

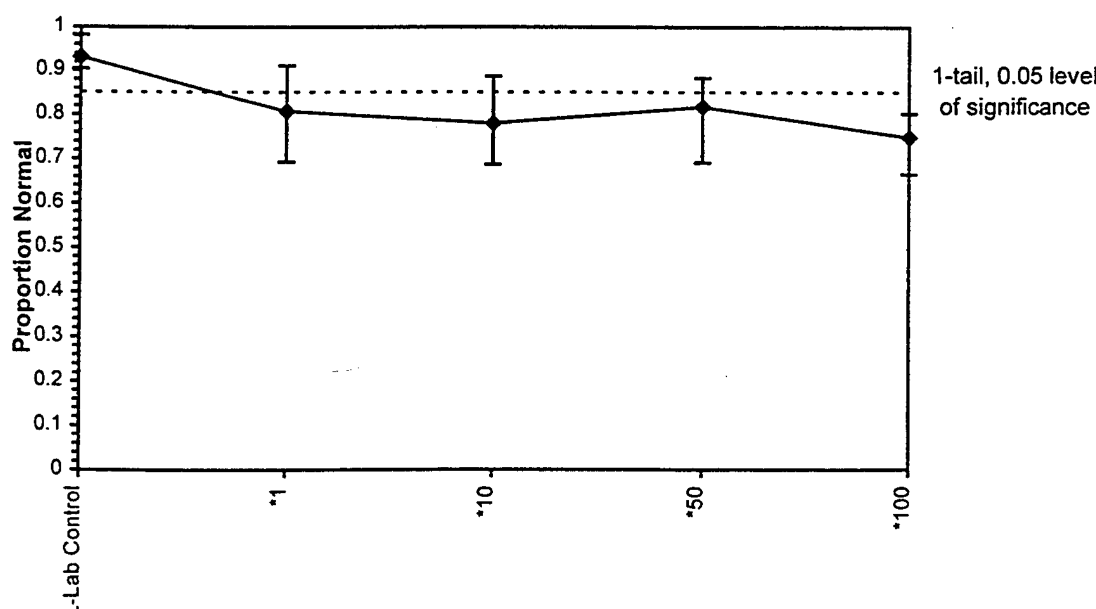
Start Date:	11/7/97	Test ID:	9711-019	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 8				

Conc-	1	2	3	4	5
L-Lab Control	0.9138	0.9444	0.9817	0.9091	0.9040
1	0.7938	0.8857	0.6944	0.7549	0.9118
10	0.6875	0.7757	0.7788	0.8870	0.7699
50	0.6914	0.8333	0.8584	0.8833	0.8228
100	0.7629	0.6667	0.7872	0.8033	0.7273

			Transform: Arcsin Square Root						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
L-Lab Control	0.9306	1.0000	1.3122	1.2558	1.4349	5.715	5			
*1	0.8081	0.8684	1.1265	0.9851	1.2692	10.540	5	3.279	2.300	0.1302
*10	0.7798	0.8379	1.0869	0.9776	1.2279	8.257	5	3.978	2.300	0.1302
*50	0.8178	0.8788	1.1351	0.9818	1.2222	8.101	5	3.127	2.300	0.1302
*100	0.7495	0.8054	1.0483	0.9553	1.1113	5.916	5	4.660	2.300	0.1302

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.97554		0.888		0.02767	-0.493
Bartlett's Test indicates equal variances (p = 0.79)					1.69355		13.2767			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	<1	1			0.07834	0.08382	0.05133	0.00802	0.00174	4, 20

Dose-Response Plot



 ToxCalc v5.0 Reviewed by: [illegible]

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID:	9711-020	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 9				

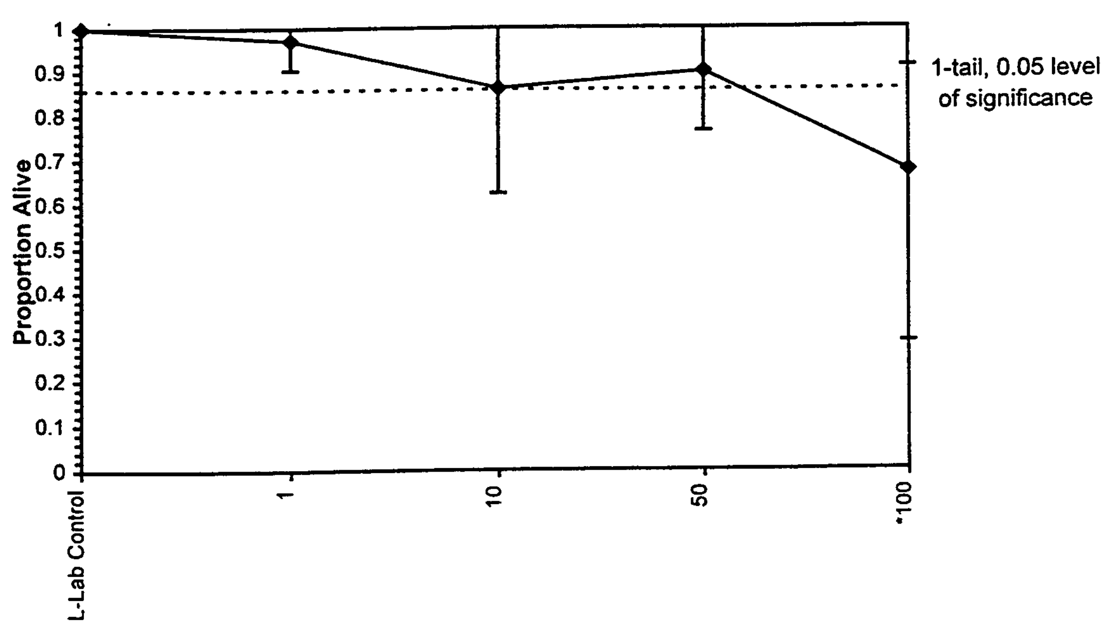
Conc-	1	2	3	4	5
L-Lab Control	1.0000	1.0000	1.0000	1.0000	1.0000
1	0.9539	1.0000	0.9046	1.0000	1.0000
10	0.8717	0.8141	1.0000	0.6250	1.0000
50	0.7977	1.0000	1.0000	0.9375	0.7648
100	0.6086	0.2878	0.9128	0.9128	0.6497

			Transform: Arcsin Square Root						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
L-Lab Control	1.0000	1.0000	1.4269	1.4269	1.4269	0.000	5			
1	0.9717	0.9717	1.3784	1.2568	1.4269	5.431	5	0.415	2.300	0.2688
10	0.8622	0.8622	1.2190	0.9117	1.4269	17.874	5	1.779	2.300	0.2688
50	0.9000	0.9000	1.2681	1.0645	1.4269	13.729	5	1.359	2.300	0.2688
*100	0.6743	0.6743	0.9881	0.5663	1.2711	29.908	5	3.754	2.300	0.2688

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.9556	0.888	-0.4602	0.63418
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	50	100	70.7107		0.1403	0.14324	0.14683	0.03415	0.01135	4, 20

Dose-Response Plot



 ToxCalc v5.0 Reviewed by: *[signature]*

Bivalve Larval Survival and Development Test-Proportion Normal

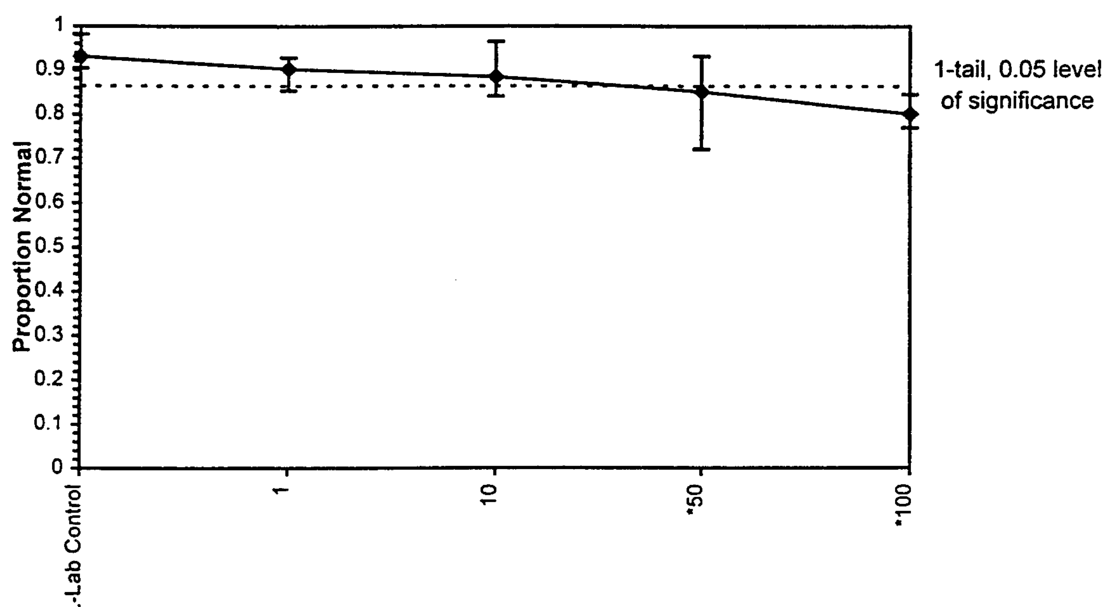
Start Date:	11/7/97	Test ID:	9711-020	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 9				

Conc-	1	2	3	4	5
L-Lab Control	0.9138	0.9444	0.9817	0.9091	0.9040
1	0.8534	0.9160	0.8909	0.9286	0.9236
10	0.8868	0.8889	0.8413	0.8421	0.9655
50	0.7216	0.8667	0.9323	0.8684	0.8710
100	0.7838	0.7714	0.7748	0.8468	0.8354

			Transform: Arcsin Square Root						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
L-Lab Control	0.9306	1.0000	1.3122	1.2558	1.4349	5.715	5			
1	0.9025	0.9698	1.2560	1.1779	1.3002	4.014	5	1.153	2.300	0.1121
10	0.8849	0.9509	1.2332	1.1610	1.3840	7.370	5	1.622	2.300	0.1121
*50	0.8520	0.9156	1.1845	1.0150	1.3076	8.916	5	2.620	2.300	0.1121
*100	0.8025	0.8623	1.1115	1.0723	1.1687	4.115	5	4.118	2.300	0.1121

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.96439		0.888		0.13162	0.81131
Bartlett's Test indicates equal variances (p = 0.47)					3.57322		13.2767			
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	10	50	22.3607		0.06582	0.07043	0.02874	0.00593	0.00678	4, 20

Dose-Response Plot



ToxCalc v5.0

Reviewed by: [signature]

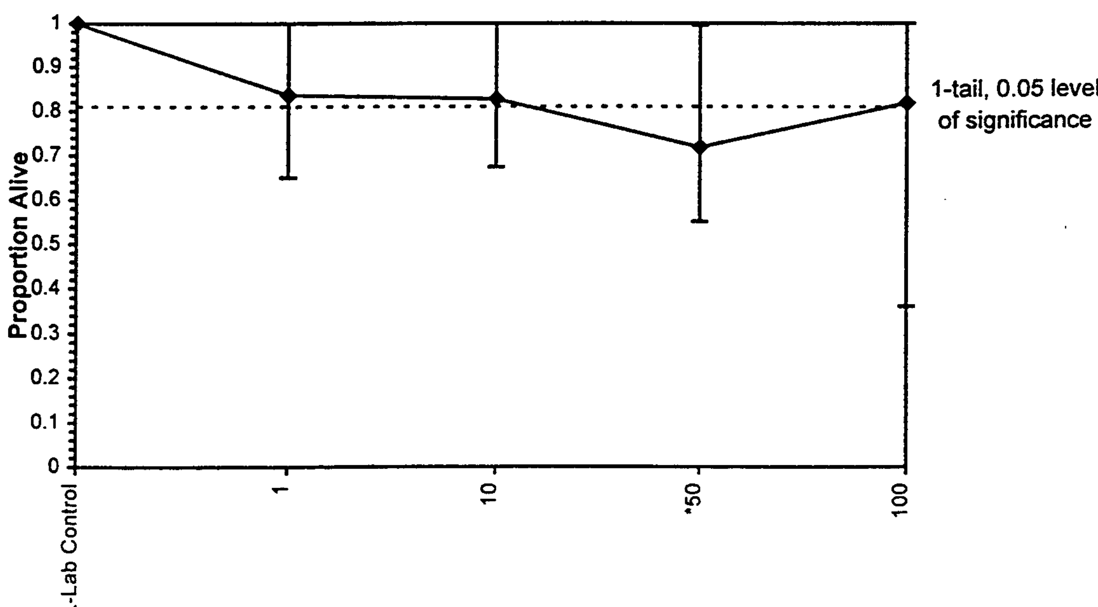
Bivalve Larval Survival and Development Test-Proportion Alive			
Start Date: 11/7/97	Test ID: 9711-021	Sample ID:	MEC-Homeporting Pearl Harbor
End Date: 11/9/97	Lab ID: CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:	Protocol: ASTM 87	Test Species:	CG-Crassostrea gigas
Comments: Site: 10			

Conc-	1	2	3	4	5
L-Lab Control	1.0000	1.0000	1.0000	1.0000	1.0000
1	1.0000	0.6497	0.8059	1.0000	0.7237
10	0.8799	0.7648	1.0000	0.6743	0.8141
50	0.7895	0.5510	0.5839	0.6743	0.9951
100	0.8964	0.3618	1.0000	1.0000	0.8388

			Transform: Arcsin Square Root						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
L-Lab Control	1.0000	1.0000	1.4269	1.4269	1.4269	0.000	5			
1	0.8359	0.8359	1.1846	0.9374	1.4269	19.408	5	1.682	2.300	0.3313
10	0.8266	0.8266	1.1594	0.9635	1.4269	15.153	5	1.857	2.300	0.3313
*50	0.7188	0.7188	1.0528	0.8365	1.5005	25.594	5	2.597	2.300	0.3313
100	0.8194	0.8194	1.1800	0.6454	1.4269	27.204	5	1.714	2.300	0.3313

Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.95682		0.888		-0.1532	0.90348
Equality of variance cannot be confirmed										
Hypothesis Test (1-tail, 0.05)	**NOEC**	**LOEC**	**ChV**	**TU**	**MSDu**	**MSDp**	**MSB**	**MSE**	**F-Prob**	**df**
Dunnett's Test	100	>100			0.18876	0.19272	0.09428	0.05188	0.16505	4, 20

Dose-Response Plot



ToxCalc v5.0

Reviewed by: MM

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	11/7/97	Test ID:	9711-021	Sample ID:	MEC-Homeporting Pearl Harbor
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	SED-Marine Sediments
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:	Site: 10				

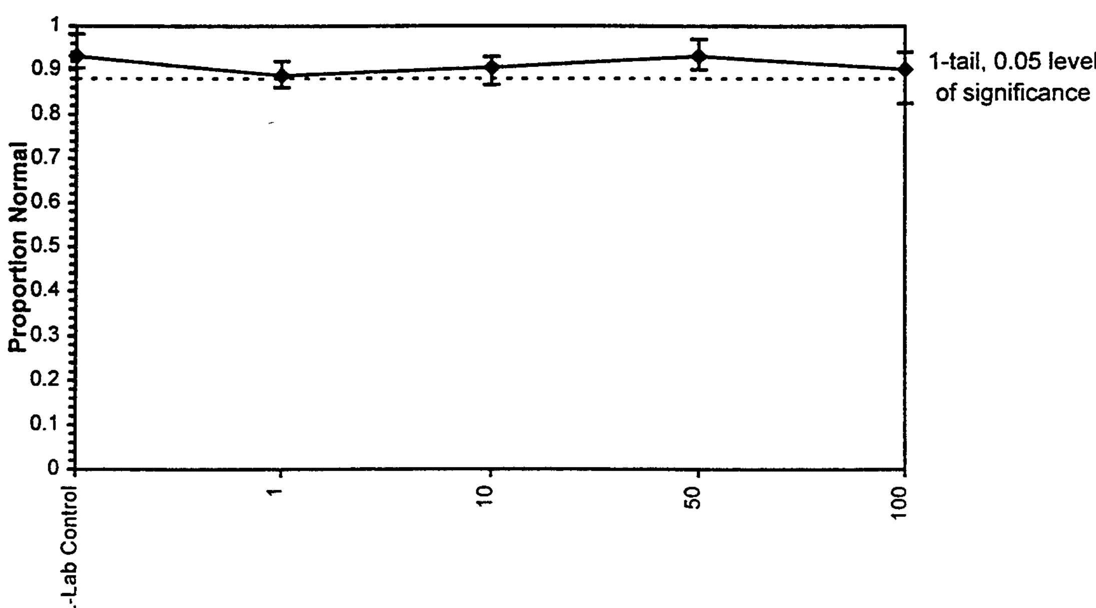
Conc-	1	2	3	4	5
L-Lab Control	0.9138	0.9444	0.9817	0.9091	0.9040
1	0.8702	0.8608	0.8878	0.8976	0.9205
10	0.9159	0.8925	0.9291	0.8659	0.9192
50	0.9375	0.9701	0.9296	0.9146	0.9008
100	0.9174	0.8864	0.8254	0.9415	0.9412

			Transform: Arcsin Square Root						1-Tailed	
Conc-	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
L-Lab Control	0.9306	1.0000	1.3122	1.2558	1.4349	5.715	5			
1	0.8874	0.9535	1.2300	1.1884	1.2849	3.080	5	2.157	2.300	0.0876
10	0.9045	0.9720	1.2586	1.1958	1.3013	3.358	5	1.406	2.300	0.0876
50	0.9305	0.9999	1.3084	1.2504	1.3972	4.278	5	0.098	2.300	0.0876
100	0.9024	0.9697	1.2597	1.1397	1.3265	6.238	5	1.378	2.300	0.0876

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)	0.98188	0.888	0.19696	0.08939
Bartlett's Test indicates equal variances (p = 0.56)	2.96735	13.2767		

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	100	>100			0.04978	0.05326	0.00628	0.00363	0.18295	4, 20

Dose-Response Plot



 ToxCalc v5.0 Reviewed by: *[handwritten initials]*

APPENDIX D

REFERENCE TOXICANT

AMPHIPOD

Appendix Table D-1. Amphipod Water Quality
Reference Toxicant Bioassay

$CdCl_2$ Concentration (mg/L)	Rep	Dissolved Oxygen (mg/L)					pH (units)					Salinity (ppt)					Temperature (°C)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
Control	A	8.3	8.5	8.3	8.1	8.1	8.14	7.96	7.89	7.84	7.84	30	28	28	28	28	15.6	14.6	14.5	14.9	14.8
	B	8.3	8.5	8.3	8.1	8.1	8.14	7.96	7.89	7.84	7.84	30	28	28	28	28	15.6	14.6	14.5	14.9	14.8
0.25	A	8.2	8.6	8.3	8.2	8.0	8.14	7.96	7.89	7.87	7.85	30	28	28	28	28	15.6	14.4	14.4	14.5	14.6
	B	8.2	8.6	8.3	8.2	8.0	8.14	7.96	7.89	7.87	7.85	30	28	28	28	28	15.6	14.4	14.4	14.5	14.6
0.50	A	8.2	8.6	8.4	8.3	8.1	8.14	7.97	7.89	7.88	7.86	30	28	28	28	28	15.5	14.3	14.3	14.4	14.5
	B	8.2	8.6	8.4	8.3	8.1	8.14	7.97	7.89	7.88	7.86	30	28	28	28	28	15.5	14.3	14.3	14.4	14.5
1.0	A	8.1	8.6	8.4	8.3	8.1	8.14	7.96	7.89	7.89	7.86	30	28	28	28	28	15.5	14.2	14.3	14.4	14.5
	B	8.1	8.6	8.4	8.3	8.1	8.14	7.96	7.89	7.89	7.86	30	28	28	28	28	15.5	14.2	14.3	14.4	14.5
2.0	A	8.2	8.6	8.4	8.4	8.1	8.14	7.96	7.89	7.90	7.87	30	28	28	28	28	15.4	14.4	14.4	14.4	14.5
	B	8.2	8.6	8.4	8.4	8.1	8.14	7.96	7.89	7.90	7.87	30	28	28	28	28	15.4	14.4	14.4	14.4	14.5
4.0	A	8.1	8.6	8.5	8.3	8.1	8.14	7.96	7.90	7.89	7.86	30	28	28	28	28	15.4	14.4	14.3	14.4	14.4
	B	8.1	8.6	8.5	8.3	8.1	8.14	7.96	7.90	7.89	7.86	30	28	28	28	28	15.4	14.4	14.3	14.4	14.4

BIVALVE

Appendix Table D-2. Bivalve Larvae Water Quality
Reference Toxicant Bioassay

$CuCl_2$ Concentration (ug/L)	Dissolved Oxygen (mg/L)				pH (units)				Salinity (ppt)				Temperature (°C)			
	0	24	48	67	0	24	48	67	0	24	48	67	0	24	48	67
Control	8.2	7.2	7.1	6.6	7.80	7.74	7.92	7.72	33	32	34	34	20.3	20.5	20.4	20.3
2.5	8.3	7.4	7.1	6.7	7.86	7.77	7.93	7.75	33	33	34	35	20.3	20.6	20.4	20.3
5	8.2	7.4	7.1	6.7	7.88	7.80	7.94	7.76	33	33	34	35	20.3	20.4	20.4	20.3
10	8.2	7.4	7.2	6.8	7.90	7.83	7.95	7.77	33	33	34	35	20.3	20.4	20.3	20.1
20	8.2	7.4	7.3	6.8	7.92	7.84	7.95	7.77	33	33	34	35	20.3	20.4	20.4	20.1
40	8.2	7.4	7.2	6.8	7.94	7.85	7.94	7.78	33	33	34	35	20.3	20.4	20.4	20.3

STATISTICAL ANALYSES

AMPHIPOD

Appendix Table D-3. Amphipod Bioassay
Reference Toxicant Survival Results

$CdCl_2$ Concentration (mg/L)	Rep	Initial Number of Amphipods	Final Number of Amphipods	Percent Survival	Average Percent Survival
Control	A	10	10	100	
	B	10	10	100	100
0.25	A	10	10	100	
	B	10	10	100	100
0.50	A	10	10	100	
	B	10	10	100	100
1.0	A	10	9	90	
	B	10	8	80	85
2.0	A	10	4	40	
	B	10	5	50	45
4.0	A	10	4	40	
	B	10	4	40	40

Amphipod 10-day Survival Bioassay-Proportion Alive

Start Date:	11/4/97	Test ID:	971104GJRA	Sample ID:	REF-Ref Toxicant
End Date:	11/8/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	CDCL-Cadmium chloride
Sample Date:		Protocol:	ASTM 93	Test Species:	GJ-Grandidierella japonica
Comments:					

Conc-mg/L	1	2
L-Lab Control	1.0000	1.0000
0.25	1.0000	1.0000
0.5	1.0000	1.0000
1	0.9000	0.8000
2	0.4000	0.5000
4	0.4000	0.4000

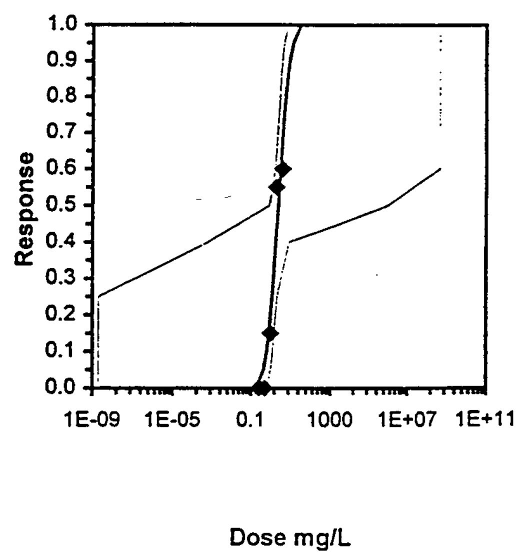
			Transform: Untransformed						
Conc-mg/L	Mean	N-Mean	Mean	Min	Max	CV%	N	Mean	N-Mean
L-Lab Control	1.0000	1.0000	1.0000	1.0000	1.0000	0.000	2	1.0000	0.0000
0.25	1.0000	1.0000	1.0000	1.0000	1.0000	0.000	2	1.0000	0.0000
0.5	1.0000	1.0000	1.0000	1.0000	1.0000	0.000	2	1.0000	0.0000
1	0.8500	0.8500	0.8500	0.8000	0.9000	8.319	2	0.8500	0.1500
2	0.4500	0.4500	0.4500	0.4000	0.5000	15.713	2	0.4500	0.5500
4	0.4000	0.4000	0.4000	0.4000	0.4000	0.000	2	0.4000	0.6000

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Normality of the data set cannot be confirmed				
Equality of variance cannot be confirmed				

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	2.21898	1.1162	0.03122	4.40674	0	0.93328	11.3449	0.82	0.38867	0.45066	3
Intercept	4.13755	0.45466	3.24641	5.02869							
TSCR											

Point	Probits	mg/L	95% Fiducial Limits	
EC01	2.674	0.21892	#######	0.72087
EC05	3.355	0.44402	#######	1.06671
EC10	3.718	0.64733	#######	1.33809
EC15	3.964	0.83482	#######	1.58626
EC20	4.158	1.02185	#######	1.85532
EC25	4.326	1.21536	#######	2.19283
EC40	4.747	1.88146	0.00062	9.0998
EC50	5.000	2.4472	0.86877	967704
EC60	5.253	3.18304	1.72362	4.9E+08
EC75	5.674	4.92757	2.61844	4.9E+08
EC80	5.842	5.86073	2.95357	4.9E+08
EC85	6.036	7.17373	3.35963	4.9E+08
EC90	6.282	9.25144	3.91026	4.9E+08
EC95	6.645	13.4876	4.83933	4.9E+08
EC99	7.326	27.3561	7.08733	4.9E+08

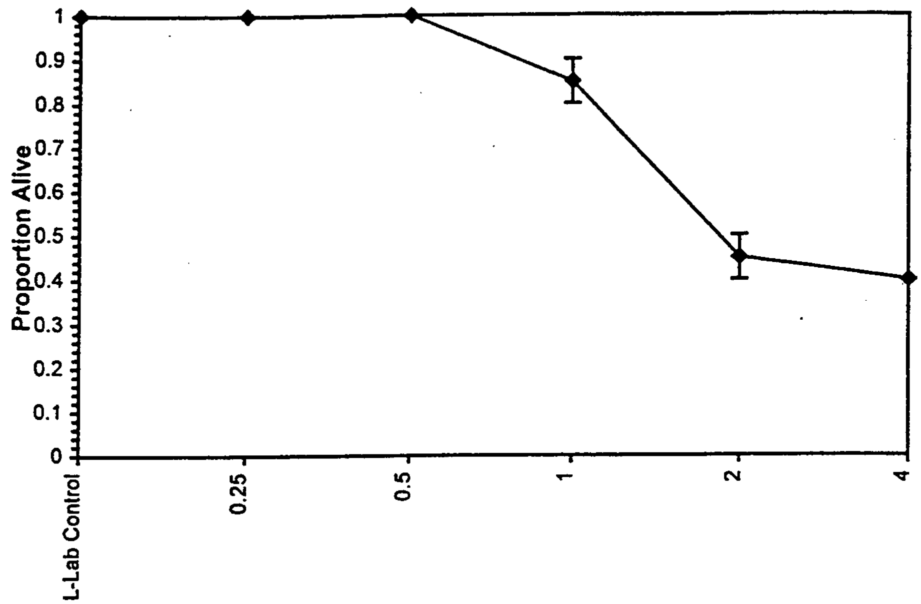


ToxCalc v5.0
Reviewed by: MW

Amphipod 10-day Survival Bioassay-Proportion Alive

Start Date:	11/4/97	Test ID:	971104GJRA	Sample ID:	REF-Ref Toxicant
End Date:	11/8/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	CDCL-Cadmium chloride
Sample Date:		Protocol:	ASTM 93	Test Species:	GJ-Grandidierella japonica
Comments:					

Dose-Response Plot



ToxCalc v5.0

Reviewed by: MG

BIVALVE

Appendix Table D-4. Bivalve Larvae Development Bioassay Reference Toxicant Survival and Normality Results

$CuCl_2$ Concentration (ug/L)	Rep	Number Normal	Number Abnormal	Total Number	Average % Survival	Percent Normal	Average % Normal
Control	A	95	14	109		87	
	B	59	11	70		84	
	C	98	15	113		87	
	D	46	5	51		90	
	E	84	3	87	- -	97	89
2.5	A	118	15	133		89	
	B	75	8	83		90	
	C	83	15	98		85	
	D	95	14	109		87	
	E	66	19	85	99	78	86
5	A	85	12	97		88	
	B	61	18	79		77	
	C	84	18	102		82	
	D	91	14	105		87	
	E	62	15	77	96	81	83
10	A	46	25	71		65	
	B	79	24	103		77	
	C	74	27	101		73	
	D	70	27	97		72	
	E	62	25	87	97	71	72
20	A	10	78	88		11	
	B	15	86	101		15	
	C	6	56	62		10	
	D	4	87	91		4	
	E	9	75	84	94	11	10
40	A	2	53	55		4	
	B	1	48	49		2	
	C	5	57	62		8	
	D	3	25	28		11	
	E	7	68	75	63	9	7

Bivalve Larval Survival and Development Test-Proportion Normal					
Start Date:	11/7/97	Test ID:	971107CGRT	Sample ID:	REF-Ref Toxicant
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	CUCL-Copper chloride
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:					

Conc-ug/L	1	2	3	4	5
L-Lab Control	0.8716	0.8429	0.8673	0.9020	0.9655
2.5	0.8872	0.9036	0.8469	0.8716	0.7765
5	0.8763	0.7722	0.8235	0.8667	0.8052
10	0.6479	0.7670	0.7327	0.7216	0.7126
20	0.1136	0.1485	0.0968	0.0440	0.1071
40	0.0364	0.0204	0.0806	0.1071	0.0933

			Transform: Arcsin Square Root						1-Tailed		Number	Total
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD	Resp	Number
L-Lab Control	0.8898	1.0000	1.2403	1.1632	1.3840	6.964	5				48	430
2.5	0.8572	0.9633	1.1870	1.0783	1.2551	5.773	5	1.213	2.360	0.1038	71	508
5	0.8288	0.9314	1.1465	1.0732	1.2114	5.029	5	2.133	2.360	0.1038	77	460
*10	0.7164	0.8051	1.0100	0.9355	1.0670	4.736	5	5.235	2.360	0.1038	128	459
*20	0.1020	0.1146	0.3201	0.2112	0.3956	21.138	5	20.915	2.360	0.1038	382	426
*40	0.0676	0.0759	0.2534	0.1433	0.3335	32.275	5	22.431	2.360	0.1038	251	269

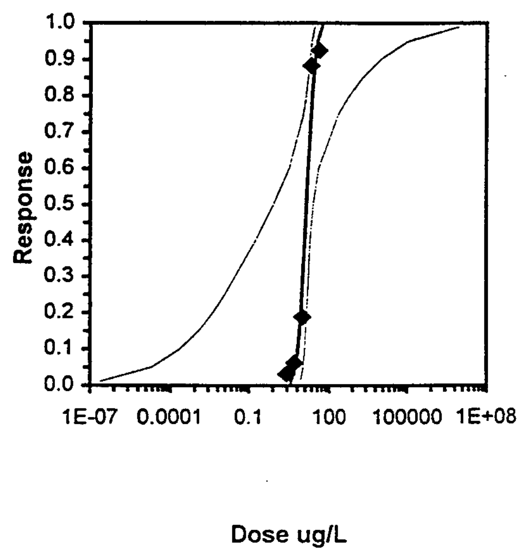
Auxiliary Tests					Statistic		Critical		Skew	Kurt
Shapiro-Wilk's Test indicates normal distribution (p > 0.01)					0.96888		0.9		-0.0629	-0.3918
Bartlett's Test indicates equal variances (p = 0.89)					1.65359		15.0863			
Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	5	10	7.07107		0.07176	0.08021	1.01558	0.00484	5.5E-19	5, 24

Maximum Likelihood-Probit

Parameter	Value	SE	95% Fiducial Limits		Control	Chi-Sq	Critical	P-value	Mu	Sigma	Iter
Slope	4.09373	1.17843	0.34343	7.84402	0.11163	51.1489	11.3449	4.6E-11	1.14193	0.24428	4
Intercept	0.32523	1.44911	-4.2865	4.93695							
TSCR	0.12103	0.04828	-0.0326	0.27467							

Point	Probits	ug/L	95% Fiducial Limits	
EC01	2.674	3.74681	#######	8.40533
EC05	3.355	5.49712	#######	10.5448
EC10	3.718	6.74343	0.00022	12.0037
EC15	3.964	7.74029	0.00112	13.1843
EC20	4.158	8.63665	0.00402	14.2891
EC25	4.326	9.48793	0.01202	15.4081
EC40	4.747	12.0239	0.17962	19.6383
EC50	5.000	13.8654	0.83573	24.8532
EC60	5.253	15.9889	3.16654	38.6234
EC75	5.674	20.2626	10.594	219.955
EC80	5.842	22.2598	12.9835	578.034
EC85	6.036	24.8376	15.2671	1921.64
EC90	6.282	28.5092	17.7179	9204.31
EC95	6.645	34.9729	21.008	98669.7
EC99	7.326	51.3103	27.1906	8982190

Significant heterogeneity detected (p = 4.55E-11)

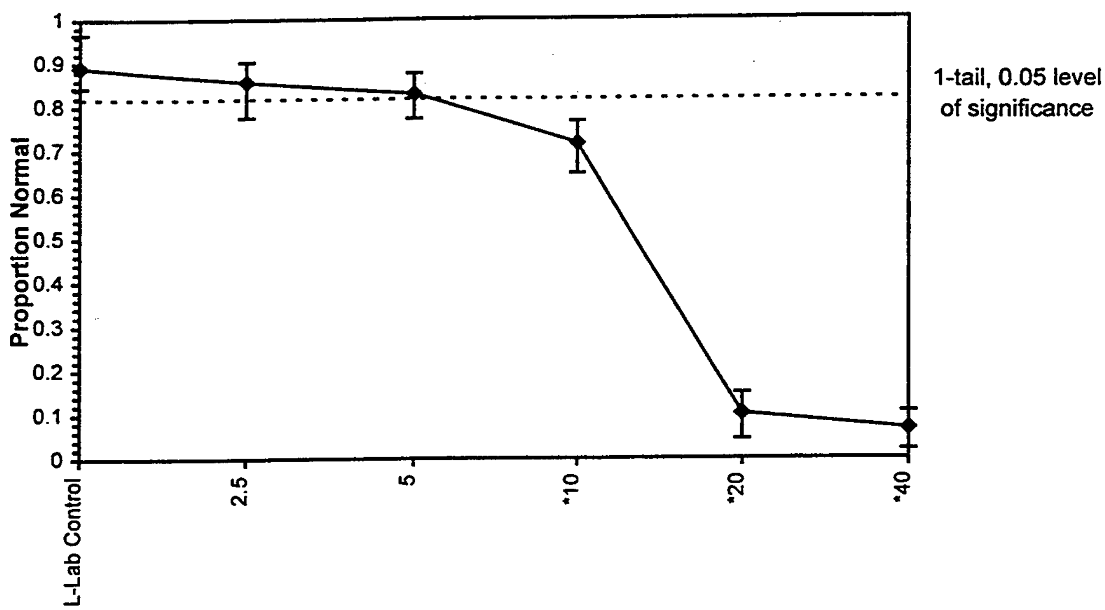


 ToxCalc v5.0 Reviewed by: Mh

Bivalve Larval Survival and Development Test-Proportion Normal

Start Date:	11/7/97	Test ID:	971107CGRT	Sample ID:	REF-Ref Toxicant
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	CUCL-Copper chloride
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:					

Dose-Response Plot



ToxCalc v5.0

Reviewed by: MH

Bivalve Larval Survival and Development Test-Proportion Alive

Start Date:	11/7/97	Test ID:	971107CGRT	Sample ID:	REF-Ref Toxicant
End Date:	11/9/97	Lab ID:	CAOEE-Ogden Bioassay	Sample Type:	CUCL-Copper chloride
Sample Date:		Protocol:	ASTM 87	Test Species:	CG-Crassostrea gigas
Comments:					

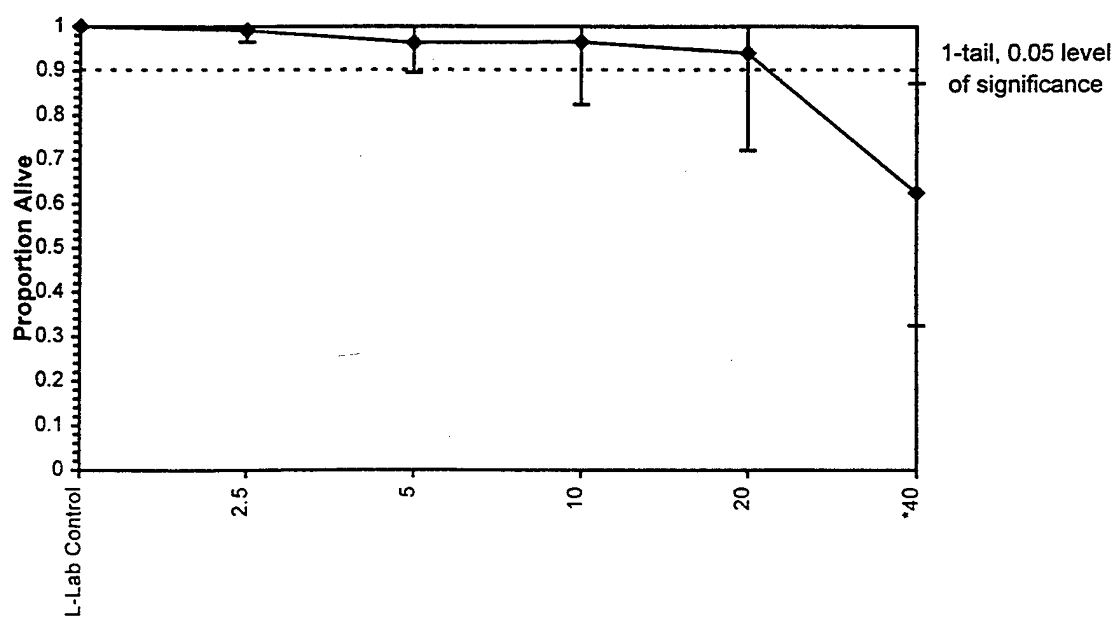
Conc-ug/L	1	2	3	4	5
L-Lab Control	1.0000	1.0000	1.0000	1.0000	1.0000
2.5	1.0000	0.9651	1.0000	1.0000	0.9884
5	1.0000	0.9186	1.0000	1.0000	0.8953
10	0.8256	1.0000	1.0000	1.0000	1.0000
20	1.0000	1.0000	0.7209	1.0000	0.9767
40	0.6395	0.5698	0.7209	0.3256	0.8721

			Transform: Arcsin Square Root						1-Tailed	
Conc-ug/L	Mean	N-Mean	Mean	Min	Max	CV%	N	t-Stat	Critical	MSD
L-Lab Control	1.0000	1.0000	1.3995	1.3995	1.3995	0.000	5			
2.5	0.9907	0.9907	1.4088	1.3829	1.4628	2.200	5	-0.115	2.360	0.1916
5	0.9628	0.9628	1.3442	1.2414	1.3995	5.722	5	0.680	2.360	0.1916
10	0.9651	0.9651	1.3476	1.1400	1.3995	8.612	5	0.639	2.360	0.1916
20	0.9395	0.9395	1.3261	1.0142	1.4177	13.159	5	0.904	2.360	0.1916
*40	0.6256	0.6256	0.9217	0.6072	1.2051	23.779	5	5.885	2.360	0.1916

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Shapiro-Wilk's Test indicates non-normal distribution (p <= 0.01)	0.83643	0.9	-1.0519	3.04979
Equality of variance cannot be confirmed				

Hypothesis Test (1-tail, 0.05)	NOEC	LOEC	ChV	TU	MSDu	MSDp	MSB	MSE	F-Prob	df
Dunnett's Test	20	40	28.2843		0.09695	0.09985	0.16926	0.01647	2.3E-05	5, 24

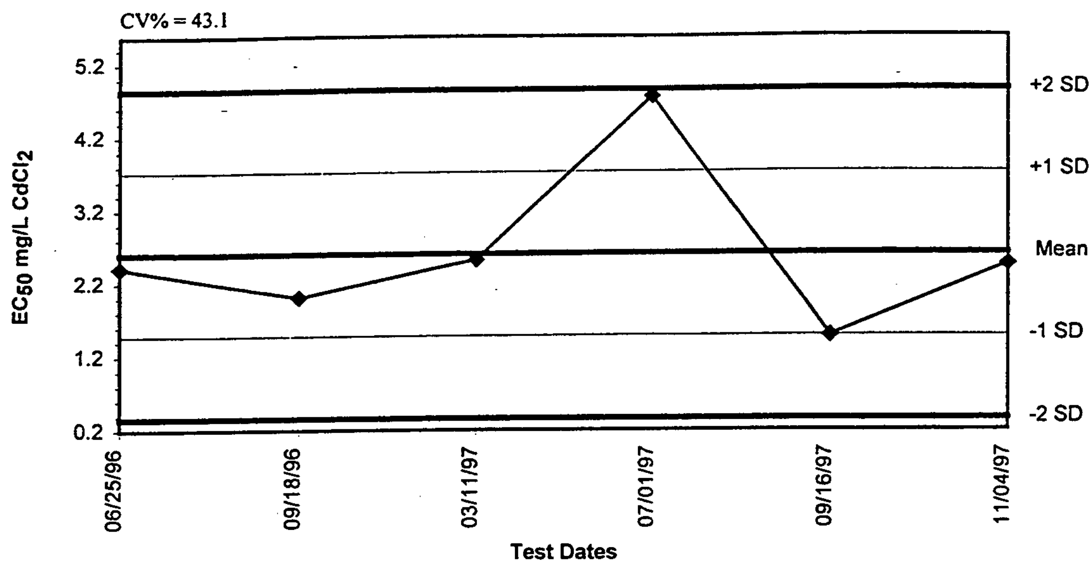
Dose-Response Plot



 ToxCalc v5.0 Reviewed by: AlA

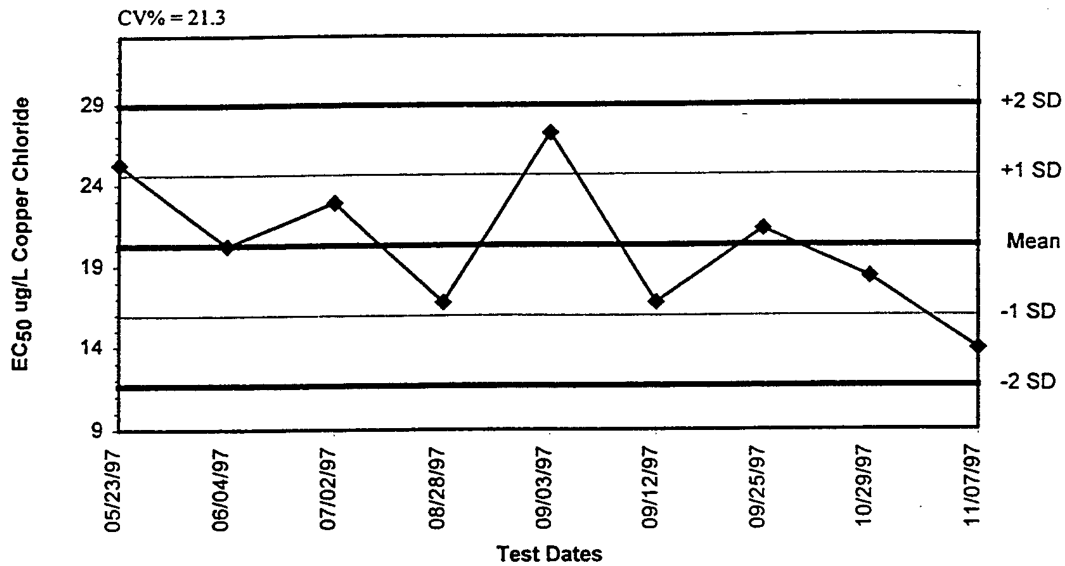
Control Charts

Grandidierella japonica 96 hr. Survival Control Chart



Dates	Values	Mean	-1 SD	-2 SD	+1 SD	+2 SD
06/25/96	2.4113	2.5999	1.4781	0.3564	3.7216	4.8433
09/18/96	2.0062	2.5999	1.4781	0.3564	3.7216	4.8433
03/11/97	2.5205	2.5999	1.4781	0.3564	3.7216	4.8433
07/01/97	4.7440	2.5999	1.4781	0.3564	3.7216	4.8433
09/16/97	1.4700	2.5999	1.4781	0.3564	3.7216	4.8433
11/04/97	2.4472	2.5999	1.4781	0.3564	3.7216	4.8433

Crassostrea gigas Normality Control Chart



Dates	Values	Mean	-1 SD	-2 SD	+1 SD	+2 SD
05/23/97	25.2228	20.2626	15.9448	11.6270	24.5804	28.8981
06/04/97	20.2377	20.2626	15.9448	11.6270	24.5804	28.8981
07/02/97	22.8654	20.2626	15.9448	11.6270	24.5804	28.8981
08/28/97	16.7294	20.2626	15.9448	11.6270	24.5804	28.8981
09/03/97	27.1307	20.2626	15.9448	11.6270	24.5804	28.8981
09/12/97	16.7280	20.2626	15.9448	11.6270	24.5804	28.8981
09/25/97	21.2497	20.2626	15.9448	11.6270	24.5804	28.8981
10/29/97	18.3340	20.2626	15.9448	11.6270	24.5804	28.8981
11/07/97	13.8654	20.2626	15.9448	11.6270	24.5804	28.8981

APPENDIX E

CHAIN-OF-CUSTODY FORMS

MEC ANALYTICAL SYSTEMS, INC.

(✓ Check One)

- ☒ 2060 Corte del Cedro • Carlsbad, CA 92009-1514 • (619) 931-9225, FAX 931-9251
- ☐ 2433 Impala Drive • Carlsbad, CA 92008 • (619) 931-8081, FAX 931-1580
- ☐ 98 Main Street, Suite #428 • Tiburon, CA 94920 • (415) 435-1847, FAX 435-0479

CHAIN OF CUSTODY

01476

DATE 10/31/97 PAGE ____ OF ____

PROJECT NAME/SURVEY/PROJECT NUMBER: Homeport - Pearl Harbor

PROJECT MANAGER: John Hardin

COMPANY: MEC

ADDRESS: See Above

PHONE/FAX:

ANALYSIS/TEST REQUESTED: Bioassay

SAMPLE I.D.	DATE	TIME	MATRIX	INITIALS	NUMBER & TYPE OF CONTAINERS Plastic Bag	Amphipod (Grandids)	Bivalve ~~(Mytilus)~~	Archive			PRESERVED HOW/ COMMENTS *2 5.4°C (1+3)
Sta-1-B	10/31/97		Marine	AM/SC	3			1645 SJr			4°C Recieved at: 5.5°C
Sta-1-T	10/31/97		Sed	JH	3						Archive [illegible] 2&3: 4.6°C [illegible]
Sta-2-B	10/31/97				1						9.0°C ~~1.0°C~~
Sta-2-T	10/31/97				1						9.9°C
Sta 3					1						Archive: 8.2°C 5.5°C
4											Archive: 7.2°C 7.2°C
5	10/30/97										9.0°C ~~1.0°C~~
6	10/31/97										chemistry-sta.4(5.5°C) 11.3°C
7	10/30/97										8.2°C
8											Archive: 4.6°C 4.6°C
9											Archive 9.9°C 3.4°C
10											Archive: 9.9°C 9.9°C

SHIPPING:

Shipping VIA: Delta Air Freight Airbill No: ____

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY
Signature: [signature]	Signature: [signature]	Signature	Signature	Signature	Signature
Firm: MEC	Firm: MEC	Firm	Firm	Firm	Firm
Date/Time: 10/31/97	Date/Time: 11/1/97 18:10	Date/Time	Date/Time	Date/Time	Date/Time

WHITE - return to originator • YELLOW - lab • PINK - retained by originator

OGDEN ENVIRONMENTAL AND ENERGY SERVICES

5550 Morehouse Drive, Suite B
San Diego, CA 92121
619-458-9044, ext. 208

Bioassay Laboratory Chain of Custody

DATE 3 Nov. 97 PAGE 1 OF 1

COMPANY MEC Analytical
ADDRESS See contract
CITY ______ STATE ____ ZIP ____
PHONE NO. 760-931-9225

John Hardin
PROJECT MANAGER
– unavailable – hf
SAMPLERS (SIGNATURE)
760-931-9225
(PHONE NUMBER)

SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	ANALYSIS REQUIRED: C. gigas (48-hr)	ANALYSIS REQUIRED: G. japonica (10d)	CONCENTRATIONS/COMMENTS	NUMBER OF CONTAINERS
Reference Sediment	11/1/97	none listed	sed	poly bag	✓	✓	homogenized and split to two aliquots – one transferred to Ogden	1

PROJECT INFORMATION	
CLIENT	MEC
P.O. NO.	on contract
SHIPPED VIA:	hand-delivered

SAMPLE RECEIPT	
TOTAL NO. OF CONTAINERS	1
CHAIN OF CUSTODY SEALS	NA
REC'D. GOOD CONDITION/COLD	y
CONFORMS TO RECORD	y

SPECIAL INSTRUCTIONS/COMMENTS:

to be tested w/ rem. sites + control expected 11/3/97.

MEC received sediment on 11/3/97 in Carlsbad.

RELINQUISHED BY
(Signature) Mickey M. [signature] (Time) 3:25
(Printed Name) Mickey Yraceburn (Date) 11/3/97
(Company) MEC

RECEIVED BY
(Signature) (Time)
(Printed Name) (Date)
(Company)

RELINQUISHED BY
(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY)
(Signature) [signature] (Time) 3:25
(Printed Name) M. Schwarz (Date) 11/3/97

Ogden Bioassay Lab Log-In No.

[redacted] D[redacted]UTIC[redacted]HITE[redacted]ARY [redacted]n Bio[redacted]Lab, [redacted] Orig[redacted]

MEC ANALYTICAL SYSTEMS, INC.

(☒ Check One)

- ☒ 6060 Corte del Cedro • Carlsbad, CA 92009-1514 • (619) 931-9225, FAX 931-9251
- ☐ 2433 Impala Drive • Carlsbad, CA 92008 • (619) 931-8081, FAX 931-1580
- ☐ 98 Main Street, Suite #428 • Tiburon, CA 94920 • (415) 435-1847, FAX 435-0479

CHAIN OF CUSTODY

02013

DATE ______ PAGE ______ OF ______

PROJECT NAME/SURVEY/PROJECT NUMBER: Pearl Harbor Homeporting / 0808

PROJECT MANAGER: J. Hardin

COMPANY: MEC

ADDRESS: 6060 Corte del Cedro

PHONE/FAX: 760 931 8081 760 931 9251

SAMPLE I.D.	DATE	TIME	MATRIX	INITIALS	NUMBER & TYPE OF CONTAINERS	ANALYSIS/TEST REQUESTED					PRESERVED HOW/ COMMENTS
Sta-1-2-T	11-3-97	1700	sediment	KL	3x1L						
Sta-1-2-B											
Sta-3											
Sta-4											
Sta-5											
Sta-6											
Sta-7											
Sta-8											
Sta-9											
Sta-10											

SHIPPING:

Shipping VIA: ______ Airbill No: ______

SPECIAL INSTRUCTIONS/COMMENTS:

RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY	RELINQUISHED BY	RECEIVED BY
Signature: [illegible]	Signature: [illegible]	Signature	Signature	Signature	Signature
Firm: MEC	Firm: Ogden	Firm	Firm	Firm	Firm
Date/Time: 11/3/97	Date/Time: 11/3/97	Date/Time	Date/Time	Date/Time	Date/Time

WHITE - return to originator • YELLOW - lab • PINK - retained by originator

SECTION 6.9

TRAFFIC IMPACT STUDY FOR AIRCRAFT CARRIER HOMEPORTING AT PEARL HARBOR

TRAFFIC IMPACT STUDY for

AIRCRAFT CARRIER HOMEPORTING at

PEARL HARBOR

Prepared for

Belt Collins Hawaii

Prepared by

May 1999

TABLE OF CONTENTS

Chapter 1
INTRODUCTION

The U.S. Navy is considering the homeporting of a new aircraft carrier at the Pearl Harbor Naval Complex on the island of Oahu, Hawaii. The aircraft carrier would be berthed at B2/3 (Figure 1-1). A new parking facility would be constructed at the site of existing Building 68 for use by crew and maintenance personnel. Crew and maintenance personnel would also use other existing parking facilities in the Pearl Harbor Naval Shipyard area west of North Road.

Operations of aircraft carriers normally follow a two-year cycle, with each portion of the cycle having a different effect on the levels of vehicular traffic at the naval base. The two-year operating cycle for the aircraft carrier is anticipated to be:

- Approximately 25% of the time, the carrier would be away on an overseas tour of duty (6 months of every 2 years). During this period there would be little traffic associated with the aircraft carrier other than travel by those family members of the crew.
- Approximately 50% of the time, the carrier would carry out normal operations and training from Pearl Harbor, with most of the time spent berthed at B2/3. During this period, the aircraft carrier would generate traffic at the naval base by the 3,217 crew and by service and delivery vehicles.
- Approximately 25% of the time, the carrier would be undergoing special depot-level maintenance while berthed at B2/3, with the work performed by workers temporarily relocated to Honolulu from the Mainland. During this period, traffic at the naval base would increase as a result of both the crew and the additional maintenance workers. The number of additional maintenance workers is expected to range between 450 and 1,300 over the course of the six-month maintenance period.

This traffic analyses reflects the six-month special depot-level maintenance portion of the normal two-year cycle since this should represent the greatest impact upon the area roadways. The traffic study addresses the following:

1. The estimated number of the peak hour vehicle trips generated by the aircraft carrier.
2. Traffic increases on the roadways providing access to the aircraft carrier and the parking facilities.
3. Impact on traffic conditions at the intersection of Kamehameha Highway with Makalapa Road/Radford Drive, the key traffic signal-controlled intersection providing access to the parking areas for the aircraft carrier crew and maintenance personnel.
4. Impact on traffic conditions at the intersections of North Road with Makalapa Road, Avenue A, and Nimitz Highway/South Avenue, the key intersections within the base that would be affected by traffic traveling to/from the aircraft carrier.

The traffic analysis focuses on the peak hours for arrival (6:30 to 7:30 AM) and departure (4:00 to 5:00 PM) of the carrier day shift personnel, whose normal work hours are 7:30 AM to 4:30 PM. The assessment represents conditions in year 2005.

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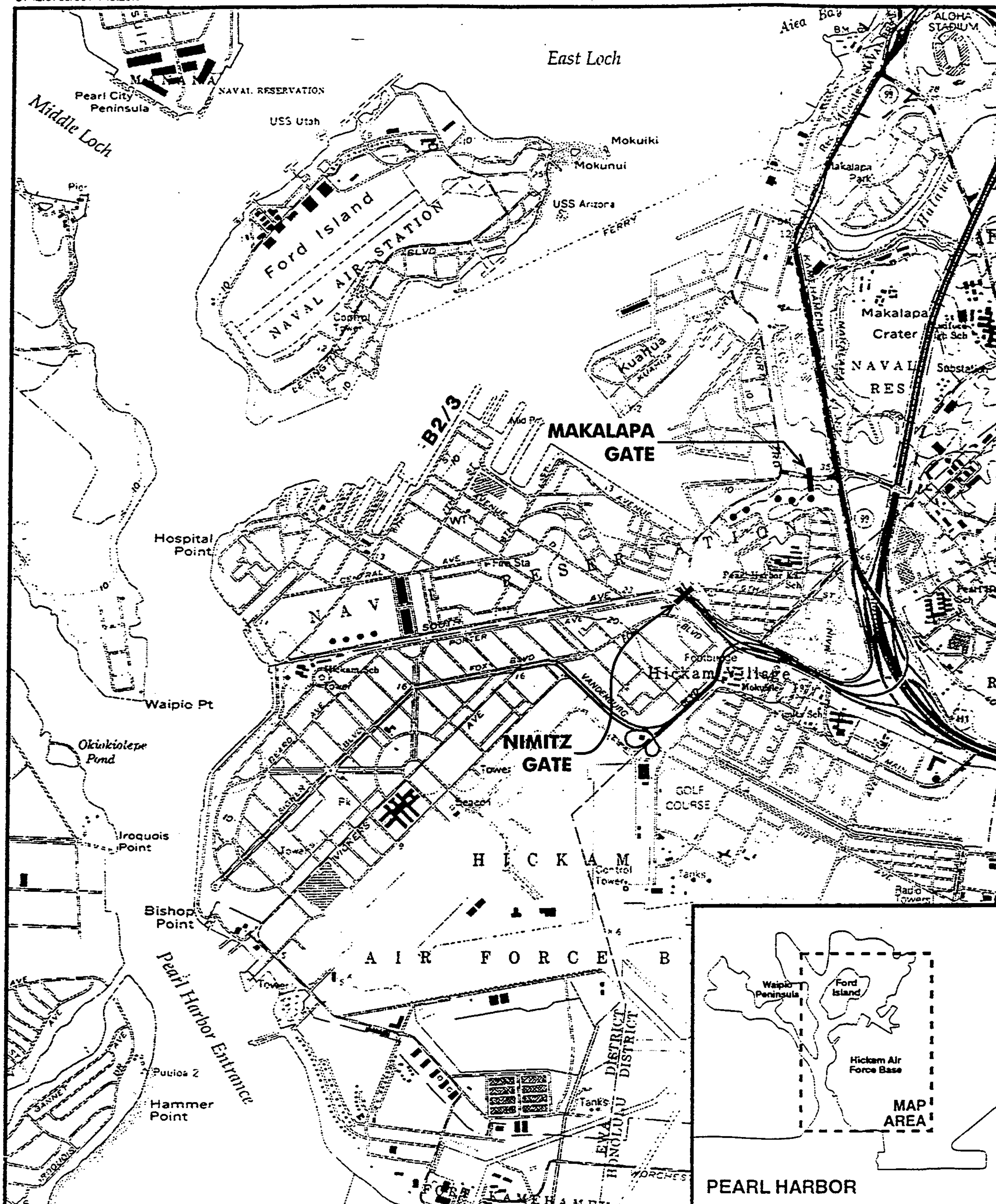


Source: *CVN Homeport Analysis*, Belt Collins Hawaii, 9/97

NORTH

0 600 1200 2400

SCALE IN FEET

WSA

Figure 1-1

PROJECT LOCATION

Chapter 2
EXISTING CONDITIONS

The planned berth and parking location for the aircraft carrier are located within the core area of the Pearl Harbor Naval Complex. The Berth B2/3 area, planned for use by the aircraft carrier, is located at the northeast end of the Pearl Harbor Naval Shipyard and adjacent to the Pearl Harbor Naval Station. The planned site for the parking structure serving the carrier would be located approximately 2,000 feet east of the berths on the site of Building 68.

EXISTING ROADWAYS

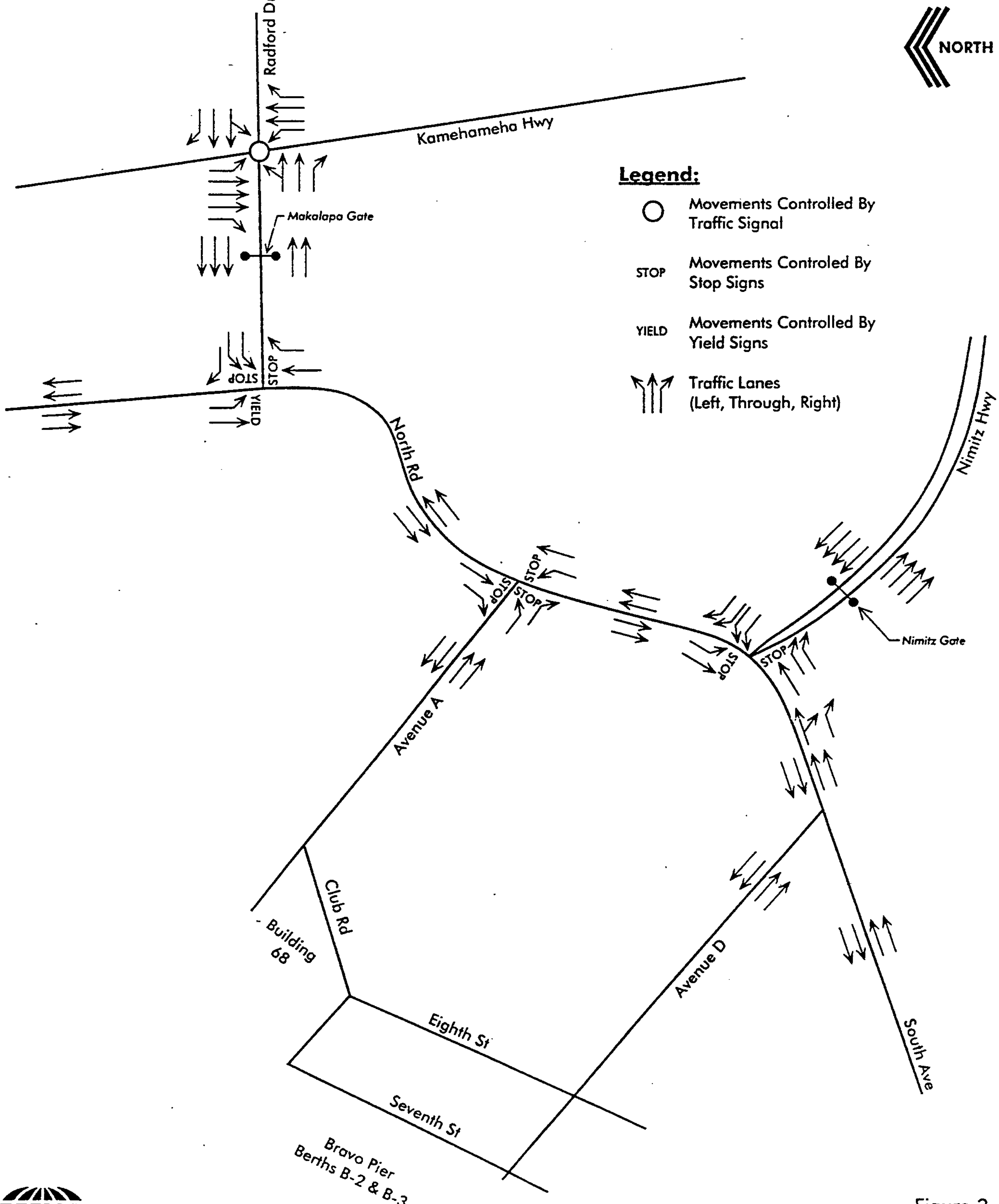
The primary regional access to the Pearl Harbor Naval Complex is provided by the H-1 Freeway and the Nimitz-Kamehameha Highway facilities. The Pearl Harbor interchange provides the primary linkage between the H-1 Freeway and the local area roadway network. Most traffic to/from the Berth B-2/B-3 area uses either the Nimitz Gate, which provides access to both the H-1 Freeway and the Nimitz-Kamehameha Highway facilities, or the Makalapa Gate, which provides access to Kamehameha Highway. Within the base, traffic would use either North Road and Avenue A, or South Avenue and Avenue D to travel to and from the carrier berth and parking areas. The principal roadways in the study area, with the number of lanes and type of traffic controls at key intersections, are depicted in Figure 2-1.

Nimitz Highway - This State highway links the Pearl Harbor Naval Complex to the H-1 Freeway and to the Honolulu International Airport and Downtown Honolulu areas. The key traffic constraints are at the Nimitz Gate, where up to four inbound lanes and four outbound lanes can be provided through the security checkpoint, and at the adjacent intersection with North Road and South Avenue inside the Naval Station.

Kamehameha Highway - This State highway connects to the Nimitz Highway and to the H-1 Freeway at the Pearl Harbor interchange to provide access to the east. Kamehameha Highway extends west to provide access to the central and western areas of Oahu. In the Pearl Harbor area, the highway typically provides three through lanes in each direction and has a landscaped median divider separating the two travel directions.

Makalapa Road - This roadway connects Kamehameha Highway to North Road, and extends eastward as Radford Drive to provide access to the Moanalua-Johnson Circle NEX/Commissary area and to the Moanalua Terrace military housing areas. The section west of Kamehameha Highway is a median-divided roadway with a total of six lanes, while the section east of Kamehameha Highway is a four-lane undivided highway. At Makalapa Gate, the roadway can provide up to three inbound lanes and two outbound lanes through the security checkpoint.

North Road - This is the major roadway providing circulation within the areas of the Naval Station north of Nimitz Gate. North Road provides two lanes in each travel direction. At several



WILBUR SMITH ASSOCIATES

Figure 2-1
EXISTING LANES & TRAFFIC CONTROLS AT KEY STUDY INTERSECTIONS

AREA BASE - 11/3/97

key intersections, one of the lanes is marked as a left- or right-turn lane, thus providing only one lane for through traffic.

South Avenue - This major four-lane roadway provides access from the Nimitz Gate area to the areas of the Naval Complex west of North Road. No turn lanes are provided on South Avenue at the key intersections other than at the Nimitz Highway intersection.

Avenue A - This four-lane roadway extends west from North Road to the vicinity of Building 68, and provides access to Berths B-2/B-3 via Club Road and Avenue C.

Avenue D - This four-lane road extends west of South Avenue and would be used to access either the Building 68 parking site or Berths B2/3. In the afternoon period, traffic cones are placed at the South Avenue intersection with Avenue D to force all westbound traffic to turn right onto Avenue D, thus providing continuous flow from Avenue D onto South Avenue for traffic exiting the base.

Key Intersections - The normal number and use of lanes are indicated in Figure 2-1. However, special traffic operations are provided at several locations during the peak traffic periods to accommodate the heavy volumes of traffic.

Nimitz Highway at North Road and South Avenue

- During the peak morning arrival period, traffic cones are placed at the intersection to prohibit the through movements between the North Road and South Avenue approaches, and the left turn from North Road. This permits nonstop traffic flow from Nimitz Highway inbound to both North Road and South Avenue, with two lanes provided for each movement. The right-turn movement from South Avenue to Nimitz Highway is permitted. During the traffic counts, the coning operation extended from before 6:00 AM to about 7:10 AM.
- During the peak afternoon departure period, traffic cones are placed at the intersection to prohibit the through movement from South Avenue to North Road and the left-turn movement from Nimitz Highway to South Avenue. This permits nonstop traffic flow from both North Road and South Avenue to Nimitz Highway to exit the base, with two lanes provided for each of the exiting movements. During the traffic counts, the coning operation extended from about 3:10 to 4:55 PM.

North Road at Makalapa Road

- The Makalapa Road approach is striped for two left-turn and one right-turn lane. However, one of the left-turn lanes is blocked by traffic cones throughout the day other than the morning peak arrival period when a traffic control officer is present to direct traffic. At that time, the traffic cones are removed by the officer and traffic is allowed to turn left from both left-turn lanes under the officer's direction.
- During the traffic counts, a traffic control officer directed traffic movements at the intersection between about 6:00 and 7:30 AM to prevent the left-turn movement from Makalapa Road from stacking back to Kamehameha Highway. With the alternating

right-of-way with the all-way STOP sign control, the higher volumes of left-turn lane cannot be accommodated by the single left-turn lane.

- During the traffic counts, a traffic control officer directed traffic movements at the intersection between about 3:15 and 4:30 PM to expedite traffic flow.

North Road at Avenue A

- A traffic control officer directs traffic at this intersection between about 6:15 and 7:15 PM and 3:15 and 4:45 PM to expedite traffic movement.

EXISTING TRAFFIC VOLUMES

Existing weekday traffic volumes are available for several area roadways from recent State of Hawaii Department of Transportation (State DOT) 24-hour machine counts. These include the intersection of Kamehameha Highway with Makalapa Road, made on March 11-12, 1997 and on Nimitz Highway near Nimitz Gate, made on February 27, 1995. Based on these State DOT counts, the typical weekday traffic volumes are:

Kamehameha Highway, east of Makalapa Road	24,700 vehicles
Makalapa Road	
South of Kamehameha Highway	19,900
North of Kamehameha Highway	16,600
Nimitz Highway, east of Center Drive	19,800

Wilbur Smith Associates (WSA) conducted special turning movement counts at the key intersections during the weekday morning and afternoon commute peak periods. These counts were made between 6:00 and 8:30 AM and between 3:00 and 6:00 PM on October 1, 1997.

The highest one-hour volumes (peak hour) during these count periods occurred from 6:00 to 7:00 AM and from 3:15 to 4:15 PM. However, the major day work shift for the aircraft carrier personnel is expected to be 7:30 AM to 4:30 PM, which would result in most of the carrier traffic arriving and departing later than the present peak one-hour commute traffic. Most of the traffic is expected to occur between 6:30 and 7:30 AM and 4:00 and 5:00 PM. The present traffic volumes during the carrier peak arrival and departure hours are presented for the key intersections in Figures 2-2 and 2-3, respectively. The volumes in the 6:30-7:30 AM period are about 85% of those for the base morning peak hour , while the volumes in the 4:00-5:00 PM period are about 75% of those for the base afternoon peak hour.

Nimitz Gate is used by about 50% more peak direction traffic than Makalapa Gate during both the 6:30-7:30 AM and 4:00-5:00 PM periods. The highest volumes on the base roadways occur on South Avenue during the morning period and on North Road during the afternoon period.

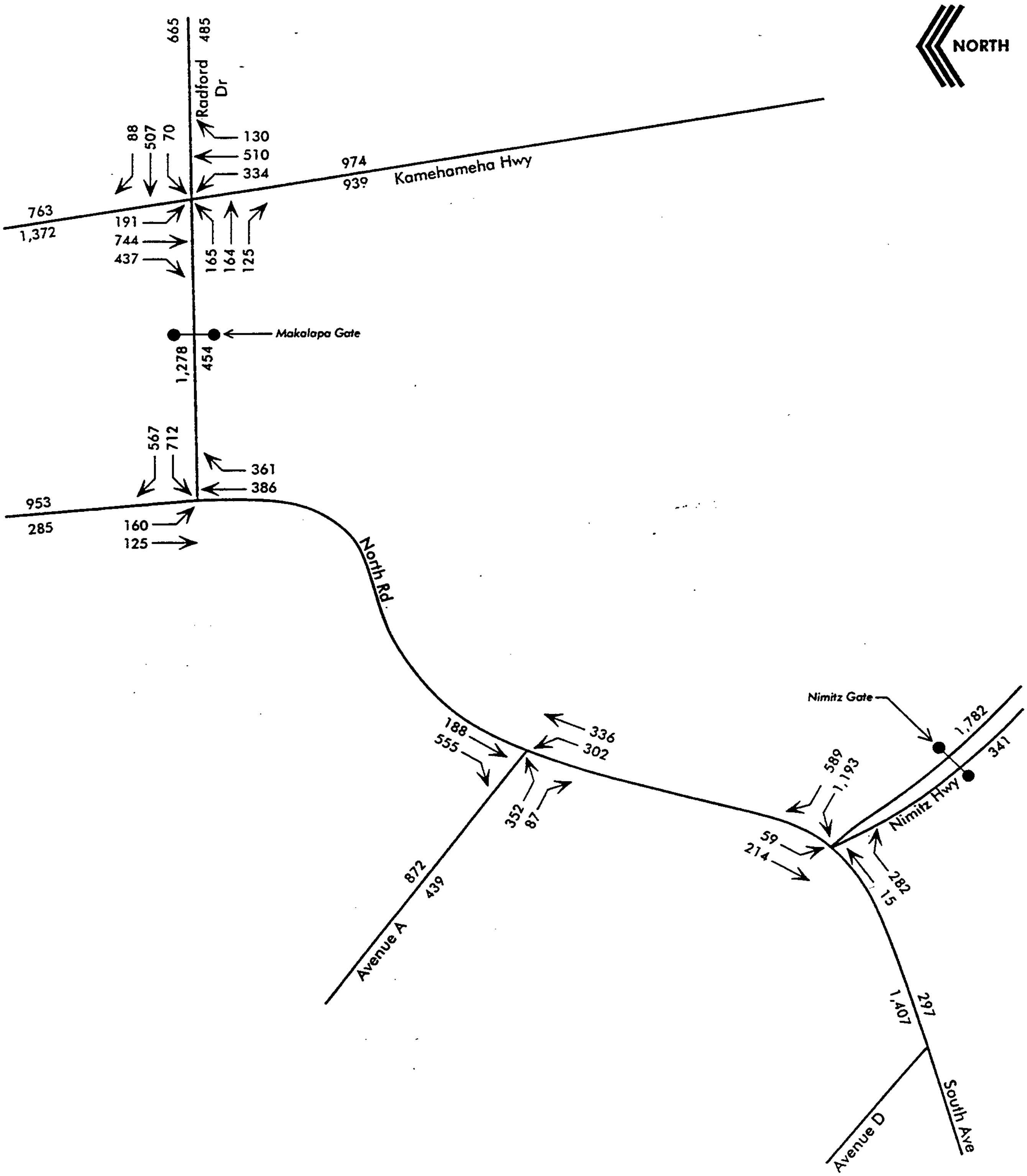
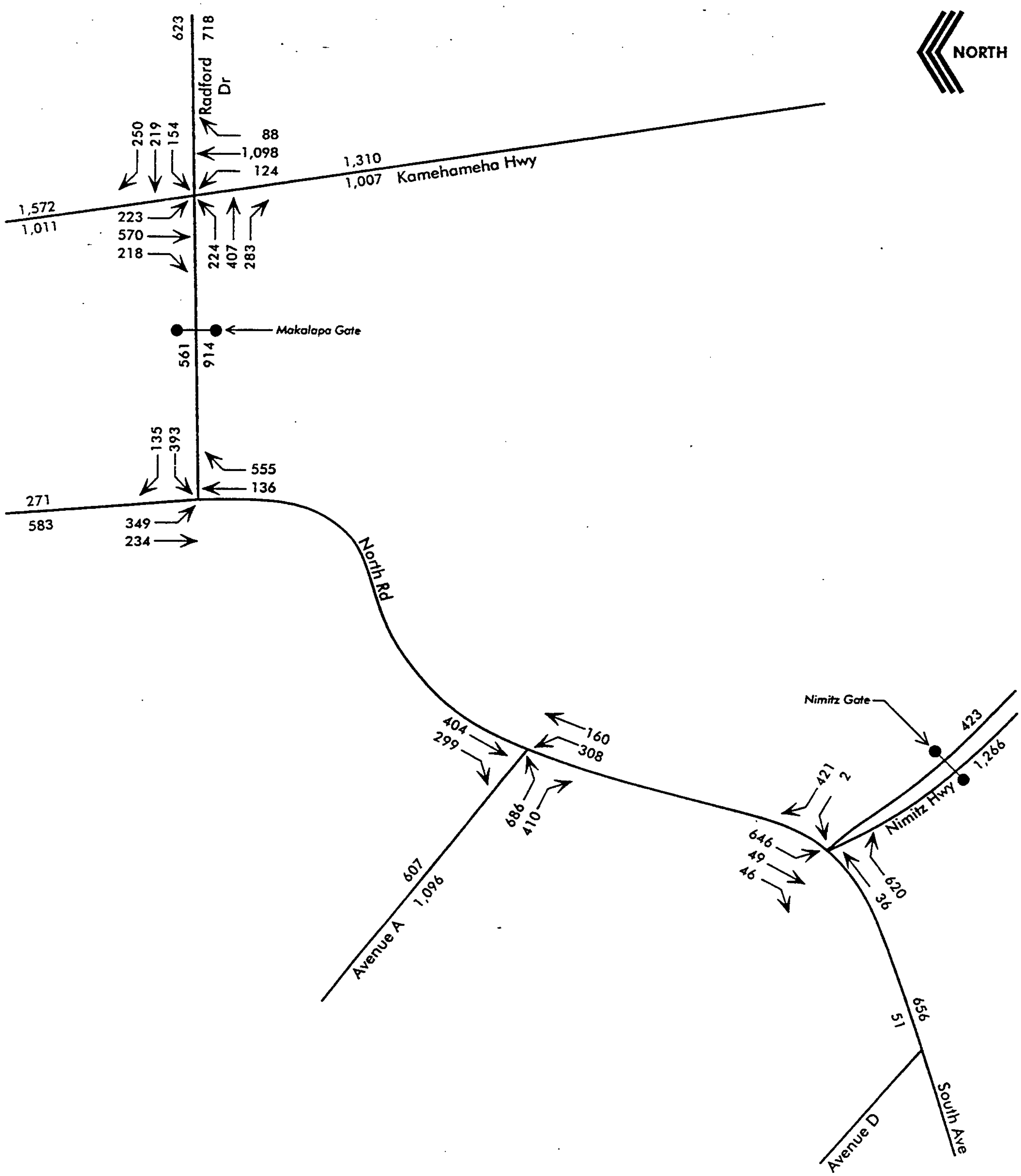


Figure 2-2
YEAR 1997 MORNING ARRIVAL
PEAK HOUR TRAFFIC (6:30-7:30 AM)

BASE - 11/3/97

WSA WILBUR SMITH ASSOCIATES



WILBUR SMITH ASSOCIATES

Figure 2-3
YEAR 1997 AFTERNOON DEPARTURE PEAK HOUR TRAFFIC (4:00-5:00 PM)

BASE - 11/3/97

EXISTING TRAFFIC CONDITIONS AT KEY INTERSECTIONS

Traffic conditions were analyzed for the morning and afternoon one-hour periods that would accommodate the highest volumes of future carrier traffic.

Methodology for Analyzing Levels of Service

The Transportation Research Board (TRB), a division of the National Science Foundation, has developed standardized methods for use in evaluating the effectiveness and quality of service for roadways and streets. Different methodologies are available for analyzing traffic signal-controlled intersections and other types of roadways.

The TRB evaluation methods use a concept known as level-of-service (LOS). This concept describes facility operations on a letter basis from A to F, which signify excellent to unacceptable conditions, respectively. The methods generally compare traffic volumes on a facility to the facility's theoretical capacity. Capacity is estimated based on the facility's physical characteristics (e.g. number and widths of lanes), traffic characteristics (e.g. types of vehicles), and type of traffic controls. The comparisons are frequently referred to as the volume-to-capacity ratio (V/C). The methodologies are described in the *1994 Highway Capacity Manual* (1994 HCM)[1].

Signal-Controlled Intersections - Traffic conditions at traffic signal-controlled intersections were evaluated using the Operations Analysis methodology described in the 1994 HCM. Using this method, the level-of-service is based on the average delay time per vehicle passing through the intersection. The delay time, calculated in seconds, is the result of the phasing and timing of the traffic signal as well as the intersection's physical layout and the composition of the traffic. Average delay time and level-of-service are estimated for the entire intersection, for each roadway approach, and for each traffic movement or lane group. A description of the characteristics and criteria associated with LOS A through LOS F is provided in Figure 2-4.

The methodology also calculates a ratio of actual or estimated peak hour traffic volumes to the theoretical capacity of the intersection. This ratio indicates the proportion of available capacity being used by traffic volumes and where there is unused capacity available for future traffic increases. This volume-to-capacity ratio (V/C) reflects the physical characteristics of the intersection and the traffic characteristics, and is somewhat independent of the efficiency of the traffic signal phasing/timing.

Unsignalized Intersections - At intersections with STOP sign controls, the level of service was calculated using the 1994 HCM procedures for intersections with STOP or YIELD signs. In this methodology, the six levels of service, A through F, are used to describe traffic conditions for those movements that must yield to other movements:

- Left-turn out of the side street or driveway;
- Through movement from the side street,

[1] *Highway Capacity Manual*. Special Report 209, Transportation Research Board, Third Edition. 1994.

The **OPERATIONS LEVEL METHODOLOGY**, which is described in the Transportation Research Board's Highway Capacity Manual, defines Level of Service (LOS) for signalized intersections in terms of delay. Technically, delay is the amount of time an average vehicle must wait at an intersection before being able to pass through the intersection. For signalized intersections, the relationship between LOS and delay is based on the average stopped delay per vehicle for a fifteen minute period.

LEVEL OF SERVICE 'A' - Delay 0.0 to 5.0 seconds

Describes operations with very low delay, i.e., less than 5 seconds per vehicle. This occurs when signal progression is extremely favorable. Most vehicles arrive during the green phase and are not required to stop at all.

Corresponding V/C ratios usually range from 0.00 to 0.60.

LEVEL OF SERVICE 'B' - Delay 5.1 to 15.0 seconds

Describes operations with delay in the range of 5 to 15 seconds per vehicle generally characterized by good signal progression and/or short cycle lengths. More vehicles are required to stop than for LOS 'A' causing higher levels of average delay.

Corresponding V/C ratios usually range from 0.61 to 0.70.

LEVEL OF SERVICE 'C' - Delay 15.1 to 25.0 seconds

Describes operations with delay in the range of 15 to 25 seconds per vehicle. Occasionally, vehicles may be required to wait more than one red signal phase. The number of vehicles stopping at this level is significant although many still pass through the intersection without stopping.

Corresponding V/C ratios usually range from 0.71 to 0.80.

LEVEL OF SERVICE 'D' - Delay 25.1 to 40.0 seconds

Describes operations with delay in the range of 25 of 40 seconds per vehicle. At LOS 'D', the influence of congestion becomes more noticeable. Many vehicles stop, and the proportion of vehicles not stopping declines. The number of vehicles failing to clear the signal during the first green phase is noticeable.

Corresponding V/C ratios usually range from 0.81 to 0.90.

LEVEL OF SERVICE 'E' - Delay 40.1 to 60.0 seconds

Describes operations with delay in the range of 40 to 60 seconds per vehicle. These high delay values generally indicate poor signal progression, long cycle lengths and high V/C ratios. Vehicles frequently fail to clear the intersection during the first green phase.

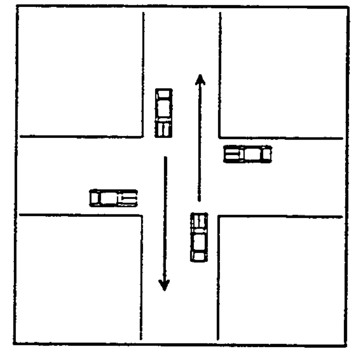
Corresponding V/C ratios usually range from 0.91 to 1.00.

LEVEL OF SERVICE 'F' - Delay 60.1 seconds plus

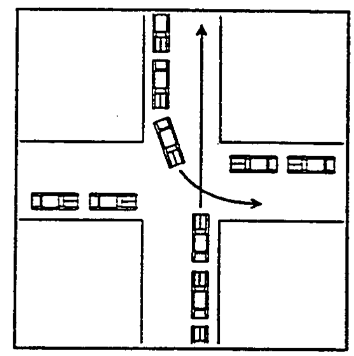
Describes operations with delay in excess of 60 seconds per vehicle. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection.

Corresponding V/C ratios of over 1.00 are usually associated.

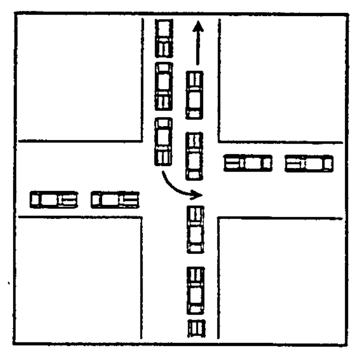
SOURCE: Transportation Research Board, "Operations Level Methodology-Signalized Intersections", *Highway Capacity Manual*, Special Report 209, 1985.



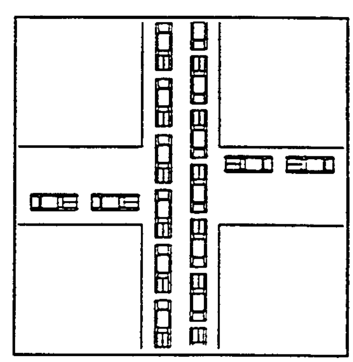
LOS 'A'



LOS 'C'



LOS 'D'



LOS 'F'

Figure 2-4
LEVEL OF SERVICE DIAGRAM

- Right-turn out of the side street or driveway; and
- Left-turn into the side street.

Through vehicles on the major streets are not required to yield to other movements at two-way STOP controlled intersections.

The general indicator of intersection delay is determined by calculating the one-hour capacity for each key movement, based on the conflicting traffic volumes, and then comparing the number of vehicles making that maneuver to the calculated capacity. The unused or "reserve" capacity for the movement is then used to identify a delay time and a level-of-service for that movement. Unlike analysis at signalized intersections, an overall intersection level-of-service is not calculated, but a level-of-service is calculated for each lane group subject to the STOP or YIELD condition.

The level-of-service criteria for unsignalized intersections with STOP or YIELD controls is defined in Table 2-1.

Table 2-1

LEVEL-OF-SERVICE CRITERIA
FOR UNSIGNALIZED INTERSECTIONS
Traffic Impact Study for
Aircraft Carrier Homeporting at Pearl Harbor

LOS	Average Stopped Delay (seconds/vehicle)
A	<5.0
B	5.1 - 10.0
C	10.1 - 20.0
D	20.1 - 30.0
E	30.1 - 45.0
F	>45

Source: Highway Capacity Manual, Special Report 209, Transportation Research Board, Chapter 10, 1994.

Intersection Conditions

The traffic conditions at each of the key intersections are summarized in Table 2-2. Since there is no established methodology for analyzing manually controlled intersections, the traffic conditions at the North Road intersections with Makalapa Road and Avenue A are presented for the present STOP sign controls without the effect of the traffic control officer. Conditions are also presented for these two intersection with traffic signal controls and the existing number of lanes, since this

may better reflect conditions with a traffic control officer assigning rights-of-way to each movement, and since traffic signals are planned for installation at both intersections.

The intersection of Kamehameha Highway with Makalapa Road accommodates the present morning traffic in the 6:30-7:30 AM period at acceptable overall traffic conditions, with the traffic approximating 72% of the intersection capacity and conditions at LOS D. Long traffic queues do form for the northbound left turn into the naval base and on the Radford Drive approach. These waiting queues typically do clear during each green phase, with LOS E conditions for these movements.

With STOP sign control, the analyses indicate that the intersection of Makalapa Road with North Road would operate at LOS F during both the morning and afternoon analyses hours. During brief periods when the traffic control officer ceased to manually direct traffic movements, long queues quickly formed on the Makalapa Road (westbound) approach, with the queue extending beyond the security gate during the morning. With the manual traffic control, the intersection was observed to operate with only short queues on each approach.

With the planned installation of traffic signal controls, the North Road-Makalapa Road intersection would operate at acceptable conditions, with the analysis hour volumes using about 64% and 55% of the capacity in the morning and afternoon analysis hours, respectively. Overall conditions would be at LOS C and D in the morning and afternoon analysis hours, respectively. The estimated conditions with the traffic signal are likely reflective of the actual present conditions with manual traffic control.

With STOP sign control, the analyses indicate that the intersection of Makalapa Road with Avenue A would operate at LOS F during both the morning and afternoon analyses hours. During the afternoon period, long queues of vehicles waiting to turn left were observed to form on Avenue A. Installation of traffic signal controls would provide acceptable conditions with the existing lanes in the morning, but not in the afternoon when the traffic volumes would approximate the capacity (see Table 2-2). The planned signal project also includes the striping of a second (double) left-turn lane on the Avenue A approach. This would provide acceptable afternoon conditions with the existing traffic volumes equal to 76% of capacity.

The Nimitz Highway intersection with North Road and South Avenue was observed to operate with minimal disruption during the period when the traffic cones were used to provide continuous flow to the peak travel direction movements. Near the end of the analyses hours for the carrier, the traffic cones were removed. The analyses of the traffic conditions during the period when the cones were not in place, as listed in Table 2-2, indicates that the STOP sign controlled movements would operate at LOS F in the morning period.

Nimitz and Makalapa Gates

Vehicles entering the Nimitz and Makalapa Gates must pass through a security checkpoint. Under normal conditions, the entering vehicles slow to permit the security guards to view the

Table 2-2

EXISTING WEEKDAY INTERSECTION CONDITIONS
Traffic Impact Study for Aircraft Carrier Homeporting at Pearl Harbor

Intersection	Traffic Control	Morning Arrival Hour			Afternoon Departure Hour		
		V/C	ADPV	LOS	V/C	ADPV	LOS
Kamehameha Hwy/ Makalapa Rd/Radford Dr.	Signal	0.721	37.8	D	0.866	44.0	E
North Rd./Makalapa Rd.	STOP Sign Signal	--- 0.640	* 20.6	F C	--- 0.547	* 20.3	F C
North Rd./Avenue A	STOP Sign Signal	--- 0.586	--- 27.3	 D	--- 1.006	* 55.8	F E
Nimitz Hwy/North Rd./ South Ave.	STOP Sign	---	140.9	F	---	11.2	C

Notes:

V/C = Ratio of traffic volumes to theoretical capacity of intersection for traffic signals and security check locations.
ADPV = Average delay per vehicle, in seconds.
LOS = Level-of-Service.
* = Not calculated.

[327250]

Wilbur Smith Associates; October 1997

base decal affixed to each vehicle. Each guard position/lane can accommodate about 600 vehicles per hour for this level of security check.[2] Based on this capacity, the present traffic volumes entering the Naval Station in the 6:30-7:30 AM period approximates 75% of the capacity at the Nimitz Gate and 71% of the capacity of the Makalapa Gate.

PUBLIC TRANSPORTATION

The City and County of Honolulu provides TheBus fixed-route service to the Pearl Harbor Naval Complex, as well as special TheHandi-Van services for those not able to use the fixed-route service. One urban trunk route and four express routes provide service within the naval base, with all four of these routes traveling on Avenue A, Club Road past the Building 68 parking site, and Eighth Street. The routes provide service within two blocks (2,000 feet) of Berths B2/3 Pier. These routes are:

- **Route 3 Kaimuki-Pearl Harbor** - Route 3 provides service to the naval base from the urban Honolulu areas east of Pearl Harbor, including the Downtown and airport areas. The route provides service from Honolulu to the Nimitz Gate seven days a week from about 5:00 AM until midnight with service frequencies generally between 10 and 30 minutes. However, service is provided along the portion of the route inside the naval base only on weekdays and Saturdays during the morning and afternoon commute periods. Route 3 provides 6 morning and 3 afternoon bus trips to the Berth B2/3 area on weekdays, and 3 morning and 2 afternoon trips on Saturdays.
- **Route 83A Wahiawa-Mililani Express** - This route provides 2 morning and 2 afternoon bus trips during weekday commute hours from the Central Oahu area and Schofield Barracks to the base.
- **Route 86A Kaneohe-Kahaluu Express** - This route provides 1 morning and 1 afternoon bus trip during weekday commute hours from the Windward Oahu area to the base.
- **Route 93A Waianae Coast Express** - This route provides 1 morning and 1 afternoon bus trip during weekday commute hours from the Waianae section of west Oahu to the base.
- **Route 95 Hawaii Kai Express** - This route provides 1 morning and 1 afternoon bus trip during weekday commute hours from the southeastern section of Oahu to the base.

In addition to these routes that provide service into the base, several other TheBus routes provide service along Kamehameha Highway with transfers possible to Route 3. These routes include:

- Route 20 Waikiki-Pearlridge
- Route 47 Waikiki/Honolulu-Waipahu
- Route 48 Honolulu-Waikele/Ewa Mill
- Route 49 Honolulu-Ewa Beach
- Route 50 Makakilo/Kapolei/Village Park-Honolulu.

[2] Traffic Impact Report, Ford Island Bridge, Pearl Harbor Naval Station, prepared by the Military Traffic Management Command, Department of the Army, December 22, 1994.

Chapter 3
2005 CONDITIONS WITHOUT CARRIER

The new aircraft carrier would be located at Pearl Harbor Naval Complex by 2005. Year 2005 is used as the basis of this analysis although the first depot-level maintenance period may not occur until 2006. Forecast conditions are presented for this 2005 analysis year as a base from which to identify the incremental effects of the aircraft carrier operations on area traffic.

PLANNED ROADWAY IMPROVEMENTS

The Ford Island Bridge, now under construction, will be open to traffic in the near future. The bridge is expected to affect traffic circulation in the area, as discussed in the next section.

Improvements are planned for two of the key intersections along North Road within the Pearl Harbor Naval Complex.

- North Road at Makalapa Road
  Installation of a traffic signal is planned for this intersection in order to more effectively use the intersection capacity. The traffic signal would permit the existing second left turn lane to be used throughout the day instead of only when there is a traffic control officer present to direct traffic. With a traffic signal, the traffic control officer should no longer be needed during the peak traffic periods.
- North Road at Avenue A
  Installation of a traffic signal is planned for this intersection. When the signal is installed, a second (double) left-turn lane will be added to the Avenue A approach to increase intersection capacity. The traffic signal should eliminate the need for a traffic control officer during peak traffic periods.

Both of these intersection improvements are assumed to be completed by 2005.

TRAFFIC GROWTH WITHOUT THE CARRIER

Traffic volumes within the study area would be affected by several factors:

- General traffic growth in the area
- Opening of the Ford Island Bridge and related changes to uses on Ford Island
- Location of the USS Missouri at Ford Island as a visitor attraction.

Area Traffic Growth Factors

A growth factor was applied to existing traffic volumes to reflect increased travel to/from the existing land uses in the area, and any increases in through traffic. Two different factors were used, with a lower one applying to traffic within or entering or exiting the Pearl Harbor Naval Complex, and a higher factor for the other traffic movements along Kamehameha Highway.

An annual growth factor of 0.5% was used for naval base traffic, including vehicles entering/exiting the base via Kamehameha Highway. This is the factor used in the previous study for the Ford Island Bridge.[1]

The growth factor for traffic along Kamehameha Highway was determined from the traffic counts for the nearest count station for which recent historic count data was available. Historic count data at the Kamehameha Highway-Radford Drive intersection (State DOT count station #5B) was used as the basis for this growth rate. The most recent data, for the 1995 to 1997 period, indicates an average annual growth rate of approximately 2.50 percent. The resultant growth factor was estimated as:

Roadways	Average Annual Growth Rate	Growth to 2005
Kamehameha Highway	2.5%	21.8%
Traffic entering, exiting, and within the navy base	0.5%	4.1%

Ford Island Bridge

Access to Ford Island is presently provided by ferries that operate from several landings in the naval base. The major landing and parking area is at Halawa Landing, located north along Kamehameha Highway near where the bridge will connect to the highway. Ferry service also operates from Merry's Point landing near the intersection of North Road and Avenue A, and from Hospital Point near Berths B2/3. Most personnel who work on Ford Island currently park near one of these landings and use the ferry service, thus they are included in the existing traffic counts.

Once the bridge is completed, traffic in the study area will change due to several factors:

- Personnel now driving to the Merry's Point and Hospital Point landings will no longer have to enter through the Makalapa and Nimitz Gates, thus reducing traffic at the key intersections within the base and, to some extent, along Kamehameha Highway.
- The SEAL operations will be relocated from Ford Island to Pearl City Peninsula, thus reducing traffic in the area.
- The development of additional housing on Ford Island would primarily affect commute period traffic through shifting the approach and departure direction of vehicles entering and exiting the navy base at Makalapa and Nimitz Gates, and should not significantly increase the overall traffic volumes. The housing would affect residence locations of existing personnel, but not increase the number of personnel. The housing would add some peak-hour trips by dependents, as well as trips during off-peak periods.

[1] Traffic Impact Report, Ford Island Bridge, prepared by the Military Traffic Management Command, Department of the Army, 1994

The net effect of the bridge on traffic patterns at the study intersections will be complex with both increases and decreases, but should not result in large changes that would greatly affect traffic conditions at the key study intersections. Therefore, no adjustments were made to the traffic volumes for the purpose of this study.

USS Missouri

The USS Missouri is planned for relocation to a berth at Ford Island prior to 2005. The ship will be operated as a companion visitor attraction to the USS Arizona Memorial. The ship will be accessed via shuttle bus service from the USS Arizona Memorial parking lot north of the study area. A restaurant may also be developed as part of the operation of the ship.

The USS Missouri is expected to increase the numbers of persons visiting the area. Most of these vehicles would travel along Kamehameha Highway through the study area. The year 2005 volumes along Kamehameha Highway were increased to reflect the USS Missouri traffic, based on the forecasts provided in the traffic impact study conducted for the ship.[2]

Peak Arrival and Departure Hour Traffic Volumes

The estimated traffic volumes at the key intersections in the study area are depicted in Figures 3-1 and 3-2 for the morning peak arrival hour and the afternoon peak departure hour, respectively.

CONDITIONS AT KEY LOCATIONS

Year 2005 traffic conditions without the aircraft carrier are summarized in Table 3-1. The conditions reflect the intersection modifications planned for the intersections of North Road with Makalapa Road and Avenue A.

Conditions at the intersection of Kamehameha Highway with Makalapa Road/Radford Drive would significantly worsen in both peak hours. In the morning period, the forecast volumes would be well within capacity (80.8%), but the increases would worsen the vehicle delay to LOS E. The projected traffic volumes would exceed intersection capacity by 5.4% in the afternoon period, with delays reflective of LOS F conditions.

Within the base, the North Road intersections with Makalapa Road and with Avenue A would both operate at acceptable levels of service with volumes well below capacity.

The estimated numbers of vehicles entering through the Nimitz and Makalapa Gates during the 6:30-7:30 AM period would be well within the estimated capacities for those two security checkpoints. The forecast volumes would approximate 77.3% of the Nimitz Gate capacity and 73.9% of the Makalapa Gate capacity.

[2] Traffic Impact Analysis Report, USS Missouri Memorial, prepared by Belt Collins Hawaii, October 1997.

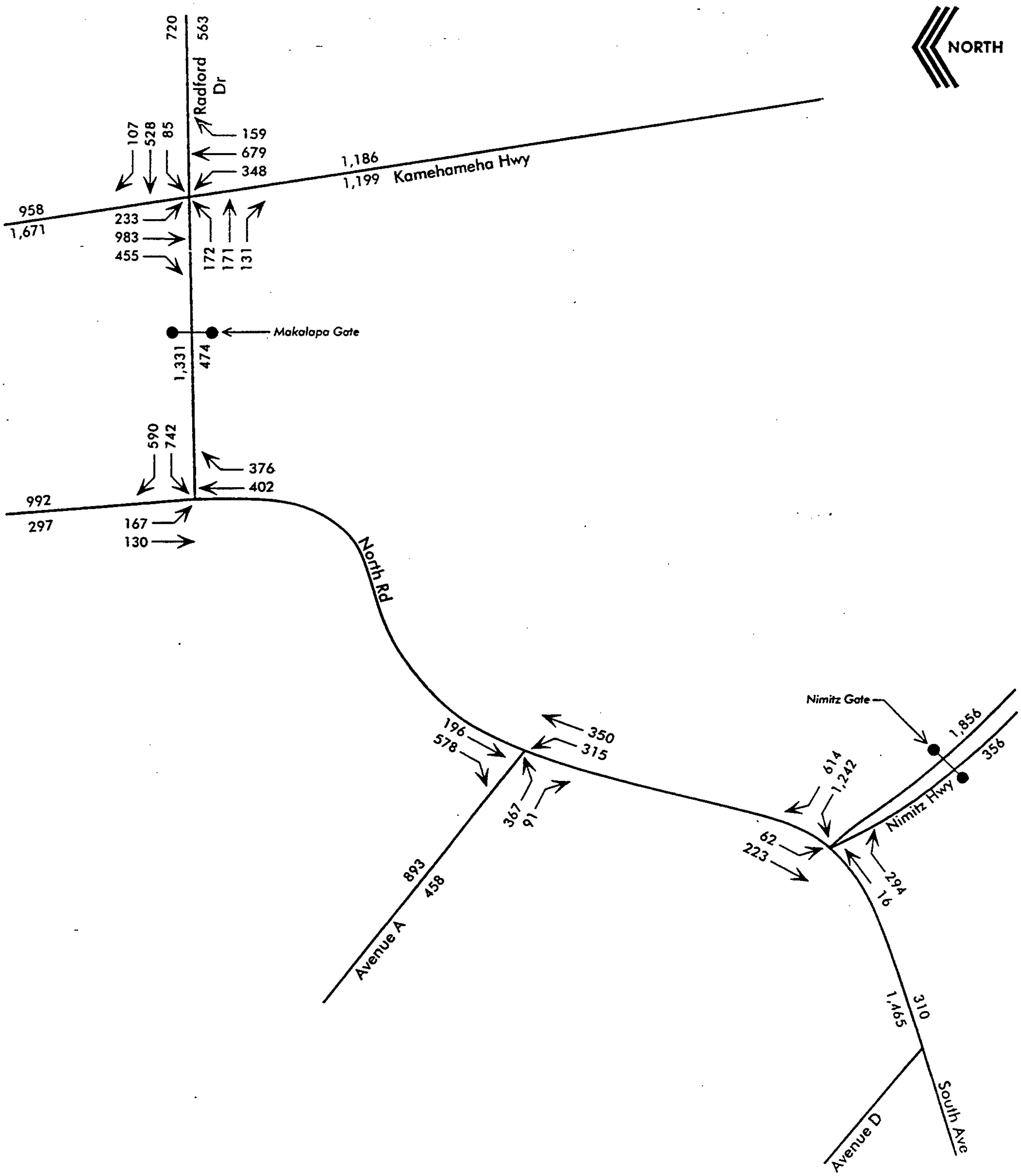


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Figure 3-1
YEAR 2005 WITHOUT CARRIER
MORNING ARRIVAL PEAK HOUR TRAFFIC

BASE - 11/3/97

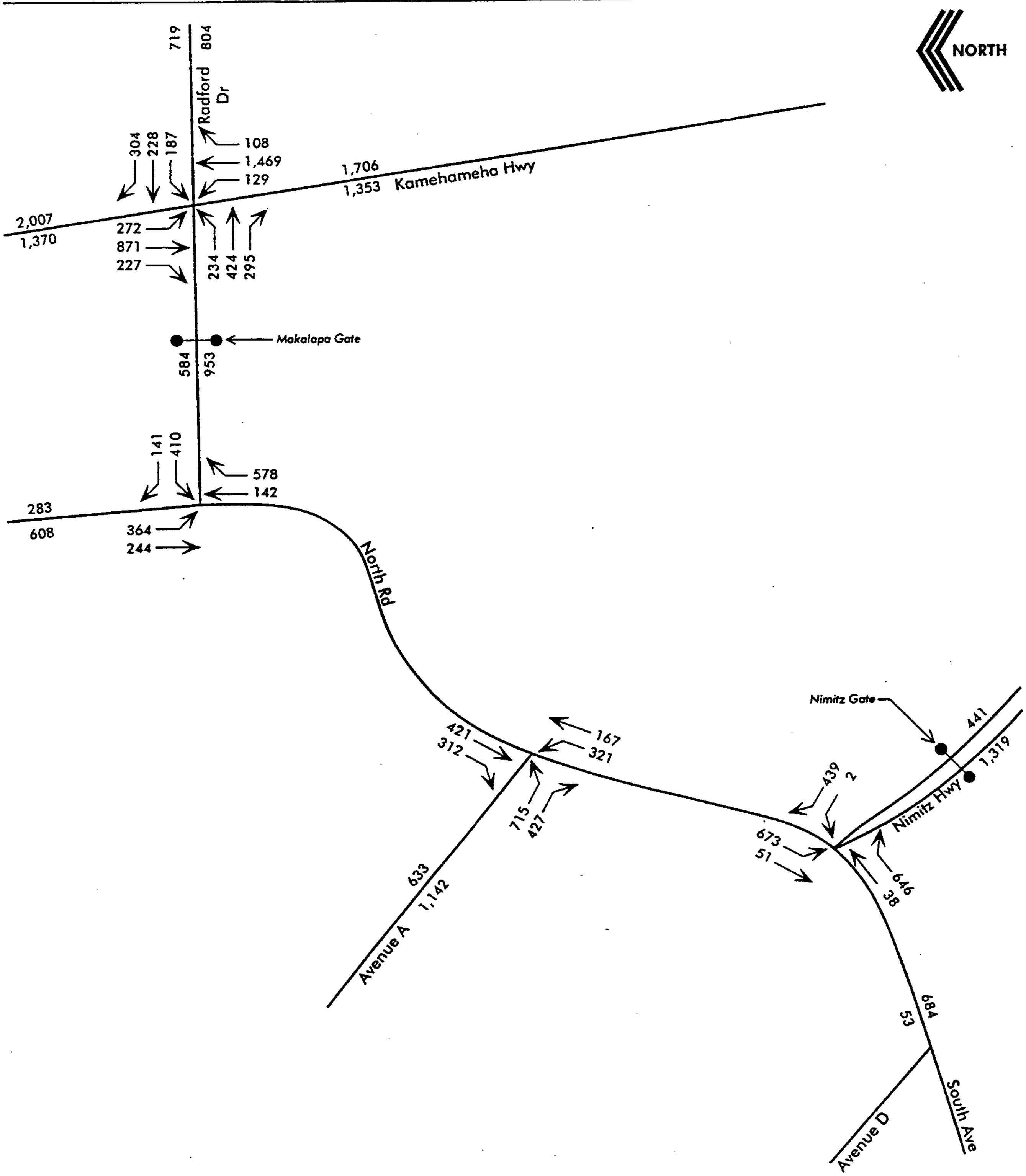

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Figure 3-2
YEAR 2005 WITHOUT CARRIER
AFTERNOON DEPARTURE PEAK HOUR TRAFFIC
BASE - 11/3/97

Table 3-1

2005 WEEKDAY INTERSECTION CONDITIONS WITHOUT THE AIRCRAFT CARRIER
Traffic Impact Study for Aircraft Carrier Homeporting at Pearl Harbor

Intersection	Traffic Control	Morning Arrival Hour			Afternoon Departure Hour		
		V/C	ADPV	LOS	V/C	ADPV	LOS
Kamehameha Hwy/ Makalapa Rd/Radford Dr.	Existing Lanes	0.808	40.2	E	1.054	66.5	F
North Rd./Makalapa Rd.	Planned Signal	0.667	21.4	C	0.571	21.2	C
North Rd./Avenue A	Planned Signals & Lanes	0.495	20.6	C	0 .798	28.6	D
Nimitz Hwy/North Rd./ South Ave.	STOP Sign	---	200.8	F	---	12.1	C

Notes:
V/C = Ratio of traffic volumes to theoretical capacity of intersection for traffic signals and security check locations.
ADPV = Average delay per vehicle, in seconds.
LOS = Level-of-Service.
* = Not calculated.

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Wilbur Smith Associates; October 1997

Chapter 4
2005 CONDITIONS WITH CARRIER

The aircraft carrier could be operating from the Pearl Harbor Naval Complex by 2005. The traffic assessment reflects conditions during depot-level maintenance phase of the operational cycle, during which both the crew and temporary maintenance workers would be working at the ship each weekday.

DESCRIPTION OF CARRIER OPERATIONS AND ASSUMPTIONS

Ship's Crew

The traffic assessment reflects a crew size of 3,217 officers and enlisted personnel remaining assigned to the ship while undergoing the depot-level maintenance. The following inputs and assumptions were used in the traffic forecasts:

- Most of the crew is assumed to work the day shift, with duty hours extending from 7:30 AM to 4:30 PM. The crew members on the evening/night shift are assumed to arrive at 4:30 PM and depart at 7:30 AM.
- Unmarried crew members with a rank of E-5 or below are assumed to live on the aircraft carrier, while all others are assumed to live in military family housing or within the residential communities of Oahu. Of the crew, 2,509 will have a rank of E-5 or less, and 44% of these personnel are expected to be married.
- On a typical day, the crew and other trips related to routine activities on the vessel are estimated to generate 850 vehicle trips during the morning and afternoon peak traffic hours, with approximately 91% of these trips inbound to the vessel in the morning peak hour and outbound in the afternoon peak hour, and the remaining 9% in the off-peak direction.[1]
- The directional distribution and routing of trips was based on the present traffic patterns for the naval base.

Depot-Level Maintenance Workers

The largest number of special maintenance workers expected to work on the vessel at any given time during the depot-level maintenance period is 1,300. These workers would be quartered outside the naval base, most likely at hotels and other short-term accommodations. The assumptions used in the analysis were selected to develop a "worst case" scenario for traffic impacts. These include:

- The special maintenance personnel are assumed to work weekdays with two work shifts each day. The shift hours are assumed to coincide with those of the crew, with the day shift working from 7:30 AM to 4:30 PM, and the second shift working from

[1] The trip generation was derived from traffic counts at West Coast naval bases. (SAIC, April 28, 1999)

4:30 PM until after midnight. One-half of the maintenance specialists are assumed to work on each shift.

- On a typical weekday, all of the personnel are assumed to work at the aircraft carrier.
- The maintenance personnel are assumed to commute to the base via a combination of rental cars, vans, and special minibus transportation. An average of 2.5 workers per vehicle was used to estimate the traffic generation.
- The directional distribution and routing of trips was based on the present traffic patterns for the naval base.

VEHICLE TRIP GENERATION

A total of 1,110 vehicle trip origins or destinations are estimated for the carrier during the morning peak hour and 1,370 for the afternoon peak hour on a weekday during the depot-level maintenance period, based on the preceding assumptions. As listed in the following table, approximately 77% and 62% of the trips in the morning and afternoon peak hours, respectively, would be made by the ship's crew and other routine daily activities. The special maintenance personnel would represent about 25% of the trips in the peak travel direction during each peak hour.

Time Period & Source of Trips	To Carrier	From Carrier	Totals
Morning Peak Arrival Hour			
Crew, deliveries, etc.	773	77	850
Maintenance Personnel	260	0	260
Totals	**1,033**	**77**	**1,110**
Afternoon Peak Departure Hour			
Crew, deliveries, etc.	77	773	850
Maintenance Personnel	260	260	520
Totals	**337**	**1,033**	**1,370**

PEAK ARRIVAL AND DEPARTURE HOUR TRAFFIC VOLUMES

The resultant year 2005 traffic volumes at key intersections during the depot-level maintenance period are depicted in Figures 4-1 and 4-2 for the peak arrival and departure hours, respectively.

The crew and maintenance personnel would result in large increases in traffic along Nimitz Highway, Makalapa Road, North Road, and South Avenue in the peak travel direction. As summarized in Table 4-1, the carrier traffic would increase peak direction traffic volumes along these road segments by between 25% and 55%. Without the maintenance personnel, the increases would approximate 18% to 40%.

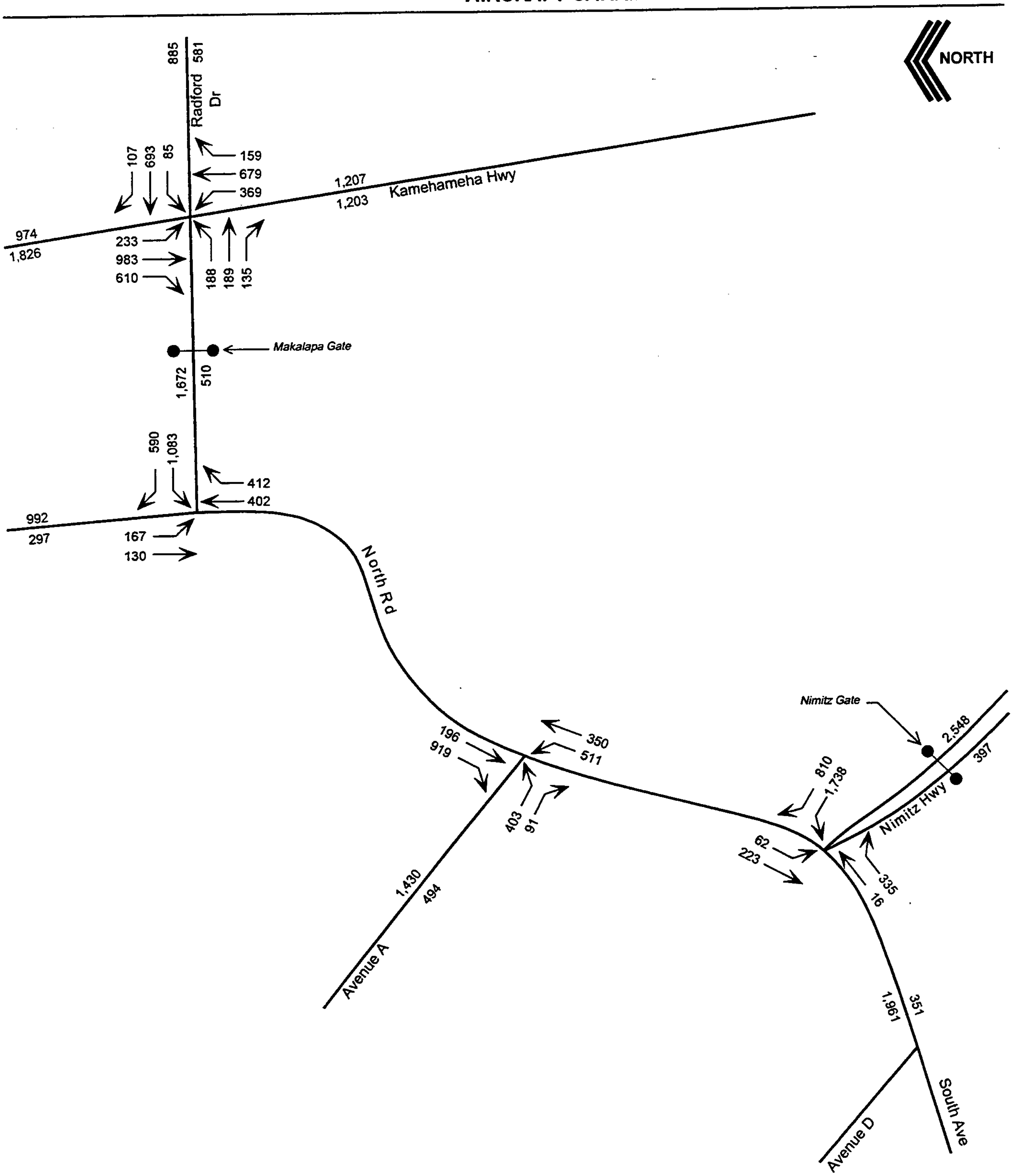

Figure 4-1
YEAR 2005 WITH CARRIER
MORNING ARRIVAL PEAK HOUR TRAFFIC

327251\BASE - 5/3/99

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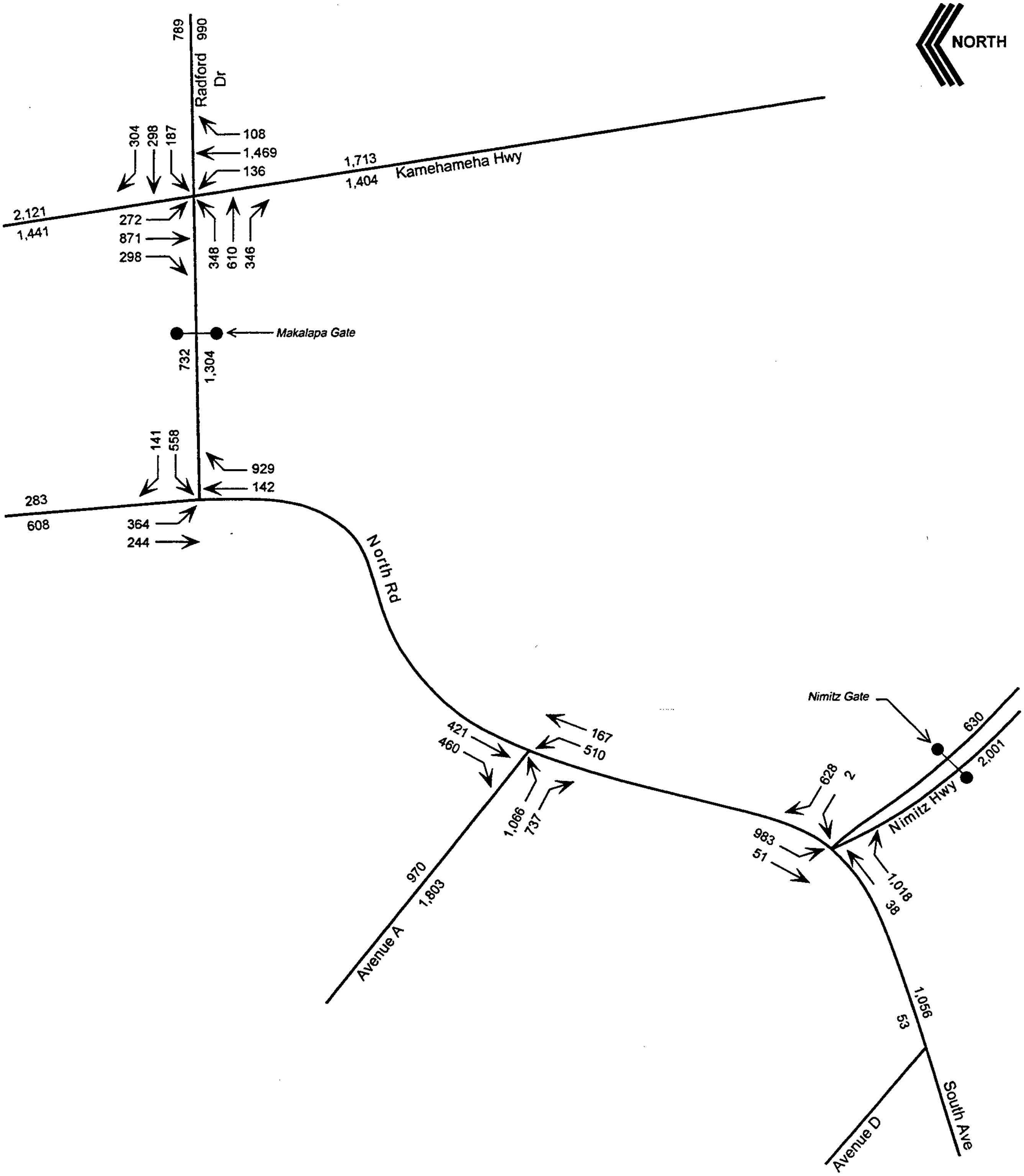

Figure 4-2
YEAR 2005 WITH CARRIER
AFTERNOON DEPARTURE PEAK HOUR TRAFFIC

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327251\BASE - 5/3/99

North of Makalapa Gate, the carrier would increase southbound traffic along Kamehameha Highway by about 9% and northbound traffic by almost 2% in the morning arrival hour. In the afternoon, the proportional increases would amount to about 6% northbound and 5% southbound.

TRAFFIC CONDITIONS AND POTENTIAL MITIGATION

Traffic conditions with the aircraft carrier undergoing special depot-level maintenance at the Pearl Harbor Naval Complex are summarized in Table 4-2 for the key intersections on the access routes into the base. The traffic conditions represent the worst case within the normal two-year operations cycle for an aircraft carrier.

Criteria Used to Identify Mitigation Needs

The impacts of the aircraft carrier on the roadway system are considered to warrant mitigation for the following types of impacts:

1. The additional traffic generated by the aircraft carrier would result in weekday peak hour traffic volumes that exceed the planned capacity of a roadway segment or a key intersection.
2. For an intersection with traffic signal controls, the additional traffic generated by the aircraft carrier would result in an increase of 0.02 or greater in the peak hour volume-to-capacity ratio of a key intersection that is projected to operate at near-capacity conditions (0.95 or greater).
3. For an intersection with STOP sign controls, the additional traffic generated by the aircraft carrier would worsen peak hour conditions to level of service F.

Kamehameha Highway Intersection with Makalapa Road/Radford Drive

The aircraft carrier traffic would significantly impact conditions at this intersection during the afternoon peak departure hour when the additional traffic would exacerbate the congested conditions anticipated without the carrier. With the carrier undergoing depot-level maintenance, the estimated traffic would exceed the intersection capacity by 17% versus traffic exceeding the capacity by about 5.4% without the carrier (Chapter 3). Without the maintenance personnel, the additional traffic associated with the carrier would increase the volume-to-capacity ratio to about 1.14. Traffic delays for all of the scenarios would reflect LOS F conditions. The additional carrier-related traffic, both with and without the depot-level maintenance traffic, would represent a significant worsening of conditions in the afternoon peak hour.

In the morning peak arrival hour, the additional traffic would result in total volumes approximating 89% of capacity. Delays would be at LOS E conditions, similar to those without the carrier.

To improve conditions, the Makalapa Road and Radford Drive approaches could each be widened by one lane. The additional lane would be used to provide an exclusive left-turn lane, with left-turns also permitted from one shared through/left-turn lane. The additional lanes would be sufficient to offset the impacts of the carrier traffic during the depot level maintenance period, with the afternoon peak hour traffic exceeding the intersection capacity by 1.5% and average delay improved to LOS E. With only the crew-related traffic, the afternoon peak hour traffic would be equivalent to 99.9% of capacity with the additional lanes.

Although the additional lanes on the Radford Drive and Makalapa Road approaches would mitigate the impacts of the carrier traffic, the intersection would operate at undesirable levels during the afternoon peak hour. To improve traffic conditions to acceptable levels, the north leg of Kamehameha Highway could be widened to provide a second (double) left-turn lane for traffic turning onto Radford Drive. This lane, combined with the additional lanes on the Makalapa and Radford approaches would improve the volume-to-capacity ratio to 0.932 in the afternoon peak hour with the depot-level maintenance traffic.

North Road Intersection with Makalapa Road

This intersection would operate at acceptable conditions with the increase in traffic, based on the planned installation of a traffic signal at this intersection.

North Road Intersection with Avenue A

The carrier would result in a large increase in the number of vehicles turning left from Avenue A during the afternoon departure hour, and a smaller increase in the number of vehicles turning left into Avenue A. With the depot-level maintenance traffic, the carrier would increase afternoon traffic from about 80% of capacity without the carrier, to about 5.2% over the intersection capacity with the carrier, resulting in a significant impact. Without the maintenance-related traffic, the crew vehicles would increase the afternoon peak hour traffic volumes to about 90% of capacity. The intersection would operate at acceptable levels in the morning with the planned installation of the traffic signal and addition of a second left-turn lane on Avenue A.

The widening of North Road to provide a second (double) left-turn lane for traffic turning from northbound North Road to Avenue A is the only minor intersection modification that would improve conditions. The additional left-turn lane would not fully offset the impacts of the crew and maintenance traffic, but it would result in acceptable conditions with the peak hour traffic equivalent to about 90.3% of capacity. With only the increased traffic from the crew, the traffic would approximate 84.3% of capacity.

Alternatively, if no improvements are made at this intersection, more of the carrier traffic would be likely to exit the area via Avenue D and South Avenue rather than Avenue A and Makalapa Gate. This route appears to have sufficient capacity to accommodate the additional number of vehicles necessary to alleviate the potential problems at Avenue A, even with no improvements beyond those currently planned for the intersection.

Nimitz Highway Intersection with North Road/South Avenue

As described in Chapter 2, this intersection is coned to restrict certain conflicting traffic movements during the peak entry and exit periods for base traffic. During the traffic surveys, the traffic cones were removed before the end of the peak hours for the carrier traffic, which are later than the existing peak hours. The service levels for the restricted movements, which are permitted during the last 15 to 20 minutes of the carrier peak hours, are projected to worsen with the addition of the carrier traffic.

With the addition of the aircraft carrier, it would be appropriate to extend the period during which these movements are restricted to 8:00 AM in the morning and to 5:30 PM in the afternoon. This would require those vehicles making these movements to use alternative routes to bypass this intersection. This would affect an estimated 78 and 40 vehicles during the morning and afternoon periods, respectively.

Nimitz and Makalapa Gates

During the depot-level maintenance period, the estimated traffic during the 6:30-7:30 AM period may exceed the capacity of the existing security checkpoint at Nimitz Gate by as much as 6%, with peak hour volumes at Makalapa Gate approximating 93% of the capacity at that security checkpoint. This would significantly impact conditions at Nimitz Gate, resulting in queuing of traffic and increased delays for traffic waiting to enter the base through the Nimitz checkpoint. The potential transportation management actions described below would reduce impacts at Nimitz Gate to less than significant levels.

Without the maintenance worker traffic, the increased crew traffic would result in total morning peak hour volumes approximating 88% of capacity at Makalapa Gate and 99% of capacity at Nimitz Gate.

Potential Transportation Management Actions

The potential congestion at the security gates and the key intersections could be reduced through one or more actions to reduce peak traffic demands. These include:

1. Use staggered start and end times for the crew and maintenance workers on the day shift to disperse the traffic over a longer period of time.
2. Emphasize the use of shuttle buses for transport of maintenance workers between their housing and the carrier.
3. Restrict use of cars by maintenance workers to those with 3 or more occupants.

Table 4-1

ESTIMATED YEAR 2005 TRAFFIC INCREASES WITH AIRCRAFT CARRIER

Roadway Location	Direction	Morning Arrival Hour			Afternoon Departure Hour		
		Traffic w/o Carrier	Increase in # of Vehicles	Percent Increase	Traffic w/o Carrier	Increase in # of Vehicles	Percent Increase
Kamehameha Hwy	Northbound	958	16	1.7	2,007	114	5.7
North of Makalapa Rd	Southbound	1,671	155	9.3	1,370	71	5.2
Radford Dr.	Eastbound	563	16	2.8	804	186	23.1
East of Kamehameha Hwy.	Westbound	720	165	22.9	719	70	9.7
Makalapa Gate	Eastbound	474	36	7.6	953	351	36.8
	Westbound	1,331	341	25.6	584	148	25.3
Nimitz Gate	Eastbound	356	41	11.5	1,319	682	51.7
	Westbound	1,856	692	37.3	441	189	42.9
North Rd.	Northbound	778	36	4.6	720	351	48.8
South of Makalapa Rd.	Southbound	872	341	39.1	654	148	22.6
North Rd.	Northbound	630	196	31.1	477	189	39.6
North of Nimitz Highway	Southbound	285	0	0.0	724	310	42.8
South Ave.	Eastbound	310	41	13.2	684	372	54.4
Southwest of Nimitz Hwy	Westbound	1,465	496	33.9	53	0	0.0

[327250]

Wilbur Smith Associates, April 1999

Table 4-2

2005 WEEKDAY INTERSECTION CONDITIONS WITH THE AIRCRAFT CARRIER
Traffic Impact Study for Aircraft Carrier Homeporting at Pearl Harbor

Intersection	Traffic Control	Morning Arrival Hour			Afternoon Departure Hour		
		V/C	ADPV	LOS	V/C	ADPV	LOS
Kamehameha Hwy/ Makalapa Rd/Radford Dr.	Existing Lanes	0.891	42.0	E	1.170	*	F
	Add 1 EB & 1 WB Lane	0:831	38.4	D	1.015	56.1	E
	Above & Add 2nd SB Left-Turn Lane	---	---	---	0.932	46.2	E
North Rd./Makalapa Rd.	Planned Signal	0.769	23.4	C	0.627	21.4	C
North Rd./Avenue A	Planned Signals & Lanes	0.627	18.1	C	1.052	*	F
	Add NB 2nd Left-Turn Lane	---	---	---	0.903	38.3	D
Nimitz Hwy/North Rd./ South Ave.	STOP Sign	---	341.7	F	---	24.2	D

Notes:
V/C = Ratio of traffic volumes to theoretical capacity of intersection for traffic signals and security check locations.
ADPV = Average delay per vehicle, in seconds.
LOS = Level-of-Service.
* = Not calculated.

[327250] Wilbur Smith Associates; April 1999

PUBLIC TRANSIT USAGE

Use of TheBus public transit system was based on trip factors developed by the 1993 survey and study of the system.[2] For the Airport area, which includes the Honolulu International Airport and Pearl Harbor Naval Complex, that study estimated that the average use of the bus services for work trips amounted to 0.066 trip ends per employee. Half of these would be trips to the area and half would be trips leaving the area. Based on this rate, the estimated number of work trips on a peak day during the depot-level maintenance period would be as follows:

Crew	212	trip ends per day
Maintenance Workers	86	
Total	298	

This would amount to about 130 persons arriving and 20 persons leaving via TheBus in the morning peak period, and the reverse number in the afternoon. If spread across the 11 present morning peak period bus trips, this would average approximately 12 riders per inbound bus and 3 riders per outbound bus. For the 8 afternoon bus trips, this would average 16 persons per outbound bus and 7 persons per inbound bus.

Field checks indicate that the buses typically have 20 to 40 passengers per bus in the peak travel direction at the perimeter of the base. Thus, there appears to be adequate total bus capacity at present to accommodate the additional usage. However, individual express bus or Route 3 bus trips could experience loads exceeding the available seats and require some standees.

[2] TheBus Comprehensive Operations Analysis, prepared for The Honolulu Public Transit Authority by Barton-Aschman Associates, Inc., August 1993.

Chapter 5
SUMMARY AND CONCLUSIONS

The U.S. Navy is considering the homeporting of an aircraft carrier at the Pearl Harbor Naval Complex. The carrier would be berthed at B2/3, with parking provided at existing lots and a new parking structure in the area near the berth. The carrier would have a crew of 3,217 personnel. For six months out of each two-year operating cycle, the carrier would undergo special depot-level maintenance, with up to 1,300 Mainland specialists temporarily relocated to Oahu for various stages of the maintenance process.

EXISTING CONDITIONS

The key intersections near the Makalapa and Nimitz Gates, which would be used by traffic to/from the carrier, presently operate at acceptable conditions. However, this requires special manual traffic control and/or restriction of traffic movements at the intersections of North Road with Makalapa Road, Avenue A, and Nimitz Highway within the naval base.

2005 CONDITIONS WITHOUT THE CARRIER

Traffic conditions during the peak arrival and departure hours (for the carrier crew) are expected to be at acceptable levels for each of the key intersections with two exceptions:

- The afternoon traffic at the intersection of Kamehameha Highway and Makalapa Road/Radford Drive is projected to exceed capacity by about 5% and result in LOS F conditions.
- The morning traffic at the Nimitz Highway intersection with North Road/South Avenue would result in LOS F conditions for two minor movements, both of which are restricted during the earlier portion of the morning peak traffic period.

2005 CONDITIONS WITH THE CARRIER

The primary analyses is based on the depot-level maintenance period with 3,217 crew and 1,300 additional special maintenance personnel working on the vessel.

During normal weekday operations with the carrier in port, the crew and related activities would generate a total of about 850 vehicle trips to or from the carrier during both the morning and afternoon peak hours. During the depot-level maintenance period, the special maintenance workers would add 260 and 520 vehicle trips during the morning and afternoon peak hours, respectively.

During the special maintenance period, the carrier-related traffic would increase the peak direction traffic during the morning peak arrival hour, by 37.3% at Nimitz Gate, 25.6% at Makalapa Gate,

and 9.3% on Kamehameha Highway north of the Makalapa Road intersection. Without the special maintenance workers, the traffic increases with only the carrier's crew would approximate 28% at Nimitz Gate, 19% at Makalapa Gate, and 7% on Kamehameha Highway north of the Makalapa Road intersection. Traffic volumes along North Road, South Avenue, and Avenue A would experience proportional increases similar to those at Nimitz Gate. Increases during the afternoon peak hour would be slightly greater than those in the morning.

The traffic increases would have a significant impact on several of the intersections. These impacts could be mitigated through the addition of turn lanes, redirecting traffic, and actions to encourage ridesharing. The locations and the proposed mitigation measures for the carrier impacts are as follows:

Kamehameha Highway at Makalapa Road/Radford Drive

The carrier would worsen conditions in the afternoon peak hour when the traffic is projected to exceed the intersection capacity with or without the carrier. The recommended mitigation actions to reduce impacts to less than significant levels are:

- Widen the Makalapa Road approach by one lane.
- Widen the Radford Drive approach by one lane.

North Road at Avenue A

With the carrier, traffic during the depot-level maintenance period would exceed the capacity of this intersection during the afternoon peak departure hour. The recommended mitigation actions to reduce impacts to less than significant levels are:

- Add a second (double) left-turn lane to the northbound approach of North Road.
- Encourage exiting traffic to use Avenue D and South Avenue to exit the naval base during the afternoon peak period.

Nimitz Highway at North Road/South Avenue

The carrier traffic would extend the duration of the morning and afternoon peak traffic periods by about 15 to 30 minutes after the existing restrictions are lifted on the movements that conflict with the predominate entry (morning) and exit (afternoon) along Nimitz Highway. These movements would be delayed by and disrupt the flow of the carrier traffic to/from the base. However, these impacts would not be significant. Actions to improve conditions for these movements would include:

- Extend the use of traffic cones to restrict those movements that conflict with the peak traffic flow until 7:30 AM and until 5:00 PM.

Nimitz Gate

Traffic volumes during the morning arrival peak hour may exceed the capacity of the security checkpoint at this gate during the depot-level maintenance period.

The significant traffic impacts at Nimitz Gate could be mitigated, and traffic conditions at the other problem locations could be improved, by the following transportation management actions:

- Use staggered work shift hours, particularly for those on the day shift.
- Emphasize the use of shuttle buses for transport of maintenance workers.
- Limit issuance of vehicle passes for maintenance worker access to the base.

The aircraft carrier is estimated to increase public transit use by an estimated 150 passenger trips in both the morning and afternoon peak commute periods. The existing bus services should have sufficient capacity to accommodate this increase.

SECTION 6.10

HAWAII AIR QUALITY DATA

Table 6.10-1. National and Hawaii Ambient Air Quality Standards

Pollutant	Averaging Time	Hawaii Standards [a,c]	National Standards [b]: Primary [c,d]	National Standards [b]: Secondary [c,e]
Ozone	8-hour	–	0.08 ppm (160 µg/m³)	Same as primary
	1-hour	0.05 ppm (100 µg/m³	0.12 ppm (235 µg/m³)	Same as primary
Carbon monoxide	8-hour	4.5 ppm (5 mg/m³)	9 ppm (10 mg/m³)	—
	1-hour	9 ppm (10 mg/m³)	35 ppm (40 mg/m³)	—
Nitrogen dioxide	Annual	0.037 pm (70 µg/m³)	0.053 ppm (100 µg/m³)	Same as primary
	1-hour	–	—	—
Sulfur dioxide	Annual	0.03 ppm (80 µg/m³)	0.03 ppm (80 µg/m³)	—
	24-hour	0.14 ppm (365 µg/m³)	0.14 ppm (365 µg/m³)	—
	3-hour	0.5 ppm (1,300 µg/m³)	—	0.5 ppm (1,300 µg/m³)
PM10	Annual (arithmetic mean)	–	50 µg/m³	Same as primary
	Annual (geometric mean)	–	—	—
	24-hour	–	150 µg/m³	Same as primary
PM2.5	Annual (arithmetic mean)	–	15 µg/m³	Same as primary
	24-hour	–	65 µg/m³	Same as primary
Total Suspended Particulate Matter (TSP)	Annual (geometric mean)	60	–	–
	Maximum Daily Average	150	–	–
Hydrogen Sulfide (H_2S)	1-hour	35 ppm (0.05 µg/m³)	–	–
Lead	Calendar quarter	1.5 µg/m³	1.5 µg/m³	Same as primary
	30-day average	–	–	–

Notes: (a) Standards, other than for ozone and those based on annual averages, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one.

(b) Concentrations are expressed first in units in which they were promulgated. Equivalent units given in parenthesis.

(c) Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health. Each state must attain the primary standards no later than 3 years after that states implementation plan is approved by the EPA.

(d) Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

(e) Not to be exceeded more than twice in 7 consecutive days.

**Table 6.10-2. 1996 DON Air Emissions of Permitted Sources
Pearl Harbor Area and Ford Island**

Activity	PEARL HARBOR AREA				
	PM_{10}	*SO_2*	*CO*	*NO_2*	*VOC*
Pearl Harbor Naval Shipyard	0.6	0	0	0	2
Naval Station, Pearl Harbor	2.1	1.2	0	0.5	0
Fleet Industrial Supply Center, Pearl Harbor	0	0	0	0	14.8
Public Works Center, Pearl Harbor	0	162.6	0	15.4	0.3
Naval Submarine Base, Pearl Harbor	0	0	0	0	0.2
Total Tons/Year	**2.7**	**163.8**	**0**	**15.9**	**17.3**
	FORD ISLAND				
Naval Station, Pearl Harbor	0	0.2	0.3	0.8	0
Public Works Center, Pearl Harbor	0	0.9	0	0.3	0
Total Tons/Year	**0**	**1.1**	**0.3**	**1.1**	**0**

Note: Naval Submarine Base, Pearl Harbor, has since been realigned into Naval Station, Pearl Harbor, and Naval Intermediate Maintenance Facility, Pearl Harbor.
Source: COMNAVBASE Pearl Harbor (1998).

Table 6.10-3. Peak Annual Construction Emissions for Homeporting 1 CVN at PHNSY.

Year/Construction Activity	Tons per Year				
	VOC	CO	NOx	SOx	PM10
Year 1					
Dredging	4.05	29.57	127.36	14.68	3.67
Controlled Industrial Facility	0.97	5.49	8.09	0.77	0.46
Annual Total	**5.02**	**35.06**	**135.45**	**15.45**	**4.13**
Year 2					
Controlled Industrial Facility	0.16	0.79	1.51	0.16	0.08
Parking Structure	0.16	0.79	1.51	0.16	0.08
Annual Total	**0.32**	**1.58**	**3.02**	**0.32**	**0.16**
Peak Year (#1)	**5.02**	**35.06**	**135.45**	**15.45**	**4.13**

Notes: (1) Dredging emissions based on a total dredging volume of 3,000,000 cubic yards (cy).

Table 6.10-4. Emission Source Data Associated with Hydraulic Dredging and Disposal Activities at Pearl Harbor - CVN Homeporting.

Construction Activity/ Equipment Type	*Power Rating (Hp)*	*Load Factor*	*# Active*	*Hourly Hp-Hrs*	*Fuel Use (Gal/Hr)*	*Hours Per Day*	*Total Work Days*	*Total Fuel Use*
Hydraulic Dredging (1)								
Generator	1,500	0.80	2	2,400	122.4	24	150	440,640
Tender Vessel	400	0.40	1	160	8.0	2	150	2,400
Survey Vessel	100	0.40	1	40	2.0	2	150	600
Runabout Vessel	60	0.40	1	24	1.2	2	150	360
Ocean Disposal (2)								
Tug Boat	2,200	0.60	1	1,320	66.0	16.0	150	158,400

Notes: (1) Based on a daily/total dredging rate of 20,000/3,000,000 cy dry, or 32,000/4,800,000 cy bulked.

(2) Based on a daily disposal rate of 32,000 cy (bulked), or eight barge loads. Total disposal volume of 4,800,000 cy (bulked). A round trip distance to the ocean disposal site would be 10 nautical miles and an average speed of 5 knots.

Table 6.10-5. Emission Factors for Dredging/Disposal Activities at Pearl Harbor - CVN Homeporting.

Equipment Type	*Fuel Type*	*Pounds/1000 Gallons (1)* VOC	CO	NOx	SO2	PM	PM10	*Source*
Stationary Engines >600 Hp	D	11.1	111.0	424.8	39.5	13.6	13.3	(1)
Power - Inboard	D	51.6	81.5	380.0	26.9	24.0	23.0	(2)
Power - Inboard	G	145.6	2676.0	101.0	6.4	1.6	1.6	(2)
Tug Boats	D	19.0	57.0	419.0	75.0	9.0	8.8	(3)

Notes: (1) AP-42, Table 3.4-1, Vol. I (EPA 1996).

(2) Development of an Improved Inventory of Emissions from Pleasure Craft in California (ARB 1995).

(3) Lloyd's Register of Shipping, London 1990, 1993, and 1995. From Acurex Env. Corp. 1996.

Table 6.10-6. Emissions for Hydraulic Dredging and Disposal Activities at Pearl Harbor - CVN Homeporting Project.

Construction Activity/Equipment Type	*Tons* VOC	CO	NOx	SO2	PM	PM10
Hydraulic Dredging						
Generator	2.4	24.5	93.6	8.7	3.0	2.9
Tender Vessel	0.1	0.1	0.5	0.0	0.0	0.0
Survey Vessel	0.0	0.0	0.1	0.0	0.0	0.0
Runabout Vessel	0.0	0.5	0.0	0.0	0.0	0.0
Ocean Disposal						
Tugboat	1.5	4.5	33.2	5.9	0.7	0.7
Total Emissions - Tons	**4.1**	**29.6**	**127.4**	**14.7**	**3.7**	**3.7**

Table 6.10-7. ADT Composite Fleet Mix MOBILE 5 VOC Emission Factors

Year	5 MPH			25 MPH			55 MPH			Composite
	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Winter
2005	5.69	6.26	0.05	1.68	1.81	0.30	1.00	1.08	0.65	1.50

Table 6.10-8. ADT Composite Fleet Mix MOBILE 5 CO Emission Factors

Year	5 MPH			25 MPH			55 MPH			Composite
	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Winter
2005	51.22	51.82	0.05	15.77	15.77	0.30	7.51	7.51	0.65	12.19

Table 6.10-9. ADT Composite Fleet Mix MOBILE 5 NOx Emission Factors

Year	5 MPH			25 MPH			55 MPH			Composite
	Winter	Summer	% Time	Winter	Summer	% Time	Winter	Summer	% Time	Winter
2005	2.63	2.63	0.05	2.02	2.02	0.30	2.59	2.59	0.65	2.42

Table 6.10-10. Worst-Case Vehicle Miles Travelled for the Pearl Harbor +1 CVN Alternative.

Project Source	Week-day ADT	Week-end ADT(1)	Annual ADT (2)	Miles/ Trip	Total Annual Miles
CVN Berthed	4,530	906	801,810	15.0	12,027,150
PIA Workers (3)	1,920	0	249,600	15.0	3,744,000
CVN Crew Dependents (4)	11,050	11,050	4,033,250	3.0	12,099,750
Onbase Motorpool Mileage (5)	NA	NA	NA	NA	150,000

(1) Week-end ADT assumed to be 20 percent of week-day estimates.

(2) Maximum annual berthing of 229 days for a CVN would occur in association with a PIA cycle.

(3) PIA worker commutes would occur for 6 months of a worst-case year.

(4) CVN crew dependent trips would occur off-base.

(5) (USN Public Works, NAVSTA Everett 1998).

Table 6.10-11. Worst-Case Annual Vehicle Emissions for the Pearl Harbor +1 CVN Alternative.

Project Scenario/Year	Pounds per Year		
	VOC	CO	NOx
+1 CVN/2005	92,614	754,122	149,423
Tons per Year	**46.3**	**377.1**	**74.7**

Table 6.10-12. Operational Emissions for One CVN at Pearl Harbor Naval Shipyard.

1 CVN	Emissions (Pounds per Year)													TOTAL EMISSIONS		TOTAL PHSY+FSC
	Vessel Power Plant	Abr Blasting	OWPF	NG Boilers	Em Gens Onboard	Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip.	Fuel Tanks	GSE	Vehicles	Lb/Yr	Ton/Yr	(Ton/Yr)
NOX					16,320					4		244	149,423	165,991	83.0	83.02
SOX					1,080					0		16		1,096	0.5	0.55
CO					3,540					1		53	754,122	757,716	378.9	378.86
PM		5			1,160					0		15	1,235	2,415	1.2	1.21
VOC			127		660	1,421	1,264	5,282		0	5,021	23	92,614	106,412	53.2	55.97

Notes: (1) Emissions based on Table 5.10-2, Volume 5.

(2) Vehicular emissions from Table 6.10-5, Voume 6, section 6.10.

Table 6.10-13. Emissions from Operation of + 1 CVN at FSC Equivalent at Pearl Harbor Naval Shipyard.

1 CVN	*Emissions (Pounds per Year)*													TOTAL EMISSIONS	
		Abr Blasting	OWPF	NG Boilers		Janitorial Supplies	Misc. VOC	Paints & Solvents	Parts Cleaner	Propane Equip	Fuel Tanks			Lb/Yr	Ton/Yr
NOx				49										49	0.02
SOx				0										0	0.00
CO				10										10	0.01
PM				6										6	0.00
VOC				3		474			496		4,549			5,522	2.76

Hawaii Air Quality Data 1991-1993

State of Hawaii
Department of Health
Clean Air Branch

TABLE III.A

NUMBER OF TIMES FEDERAL AND STATE AIR QUALITY STANDARDS EXCEEDED
(January 1991 to December 1993)

	Dept. of Health, Oahu	Pearl City, Oahu	Liliha, Oahu	Waimanalo, Oahu	Waikiki, Oahu	Makaiwa, Oahu	West Beach, Oahu	Kapolei, Oahu
CARBON MONOXIDE (1-hour standard)								
1. No. of samples	962	-	-	-	1056	-	805	721
2. Federal standard exceeded	0	-	-	-	0	-	0	0
3. State standard exceeded	2	-	-	-	0	-	2	0
PARTICULATE MATTER (24-hour standard)								
1. No. of samples	94	-	149	-	-	-	-	-
2. Federal standard exceeded	0	-	0	-	-	-	-	-
3. State standard exceeded	0	-	0	-	-	-	-	-
SULFUR OXIDES (24-hour standard)								
1. No. of samples	404	-	-	-	-	940	825	700
2. Federal standard exceeded	0	-	-	-	-	0	0	0
3. State standard exceeded	0	-	-	-	-	0	0	0
NITROGEN DIOXIDE* (24-hour standard)								
1. No. of samples	-	-	-	-	-	-	215	131
2. Federal standard exceeded	-	-	-	-	-	-	0	0
3. State standard exceeded	-	-	-	-	-	-	-	-
PM-10 (24-hour standard)								
1. No. of samples	51	147	131	142	-	-	138	141
2. Federal standard exceeded	0	0	0	0	-	-	0	1
LEAD (24-hour standard)								
1. No. of samples	145	-	148	-	-	-	-	-
2. Federal standard exceeded	0	-	0	-	-	-	-	-
3. State standard exceed	0	-	0	-	-	-	-	-

*A.Q.S. for Nitrogen Dioxide is 70 ug/m^3 (annual mean, arithmetic).

TABLE III.B

NUMBER OF TIMES FEDERAL AND STATE AIR QUALITY STANDARDS EXCEEDED
(January 1991 to December 1993)

	Sand Island, Oahu	Lihue, Kauai	Lahaina, Maui	Kihei, Maui
CARBON MONOXIDE				
(1-hour standard)				
1. No. of samples	-	-	-	-
2. Federal standard exceeded	-	-	-	-
3. State standard exceeded	-	-	-	-
PARTICULATE MATTER				
(24-hour standard)				
1. No. of samples	-	-	-	-
2. Federal standard exceeded	-	-	-	-
3. State standard exceeded	-	-	-	-
SULFUR OXIDES				
(24-hour standard)				
1. No. of samples	-	-	-	47
2. Federal standard exceeded	-	-	-	0
3. State standard exceeded	-	-	-	0
OZONE				
(1-hour standard)				
1. No. of samples	900	-	-	-
2. Federal standard exceeded	0	-	-	-
3. State standard exceeded	16	-	-	-
PM-10				
(24-hour standard)				
1. No. of samples	-	129	138	57
2. Federal standard exceeded	-	0	0	0
LEAD				
(24-hour standard)				
1. No. of samples	-	-	-	-
2. Federal standard exceeded	-	-	-	-
3. State standard exceed	-	-	-	-

SECTION 6.13

PEARL HARBOR HISTORIC INVENTORY

SECTION 6.13
PEARL HARBOR HISTORIC INVENTORY

Source: Historic Preservation Plan (Feb 1978). U.S. Naval Base Pearl Harbor (DON NAVFACENGCOM)

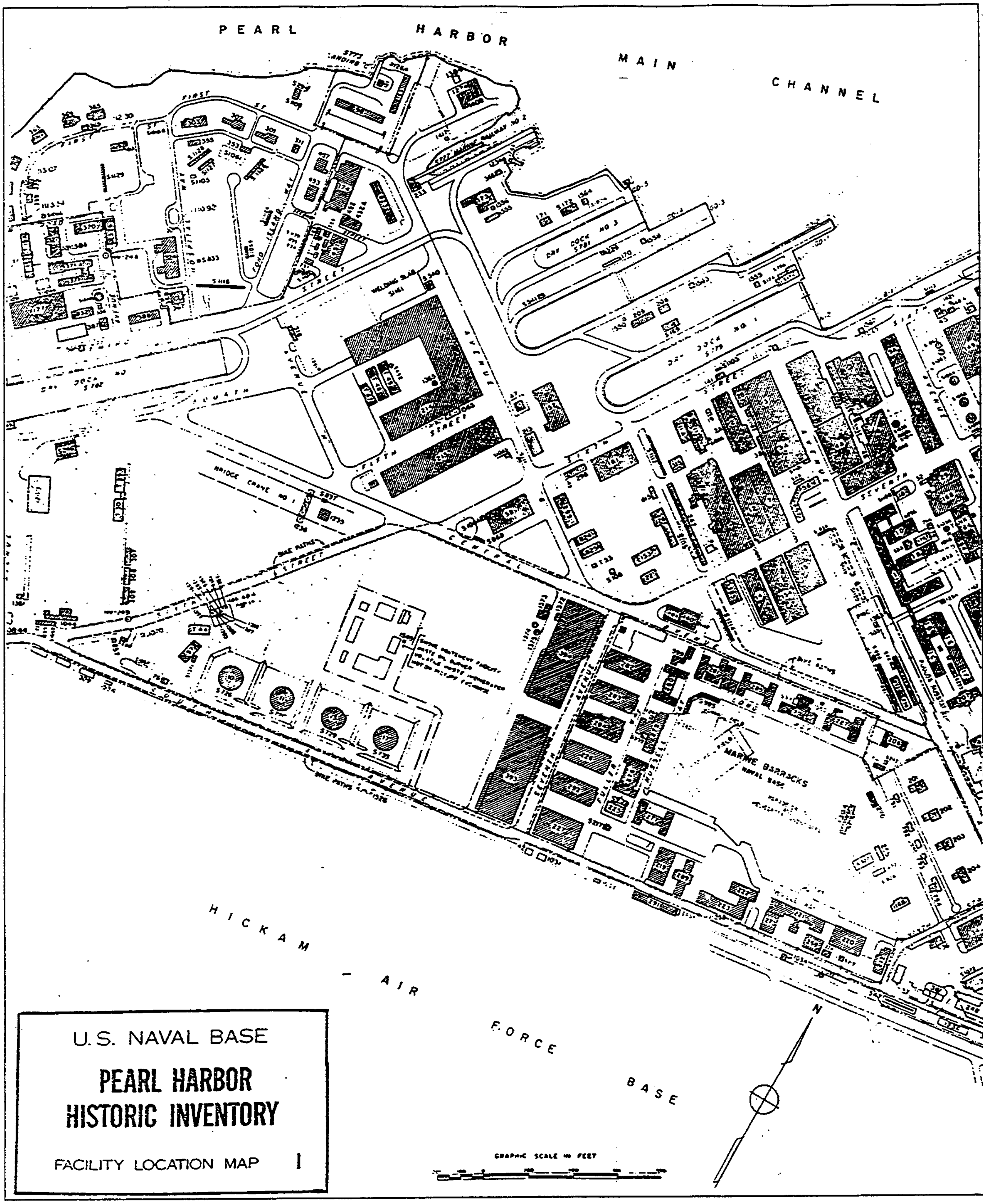

Figure 6.13-2. Historic Properties at the Proposed Project Area PHNSY (Page 1 of 2)

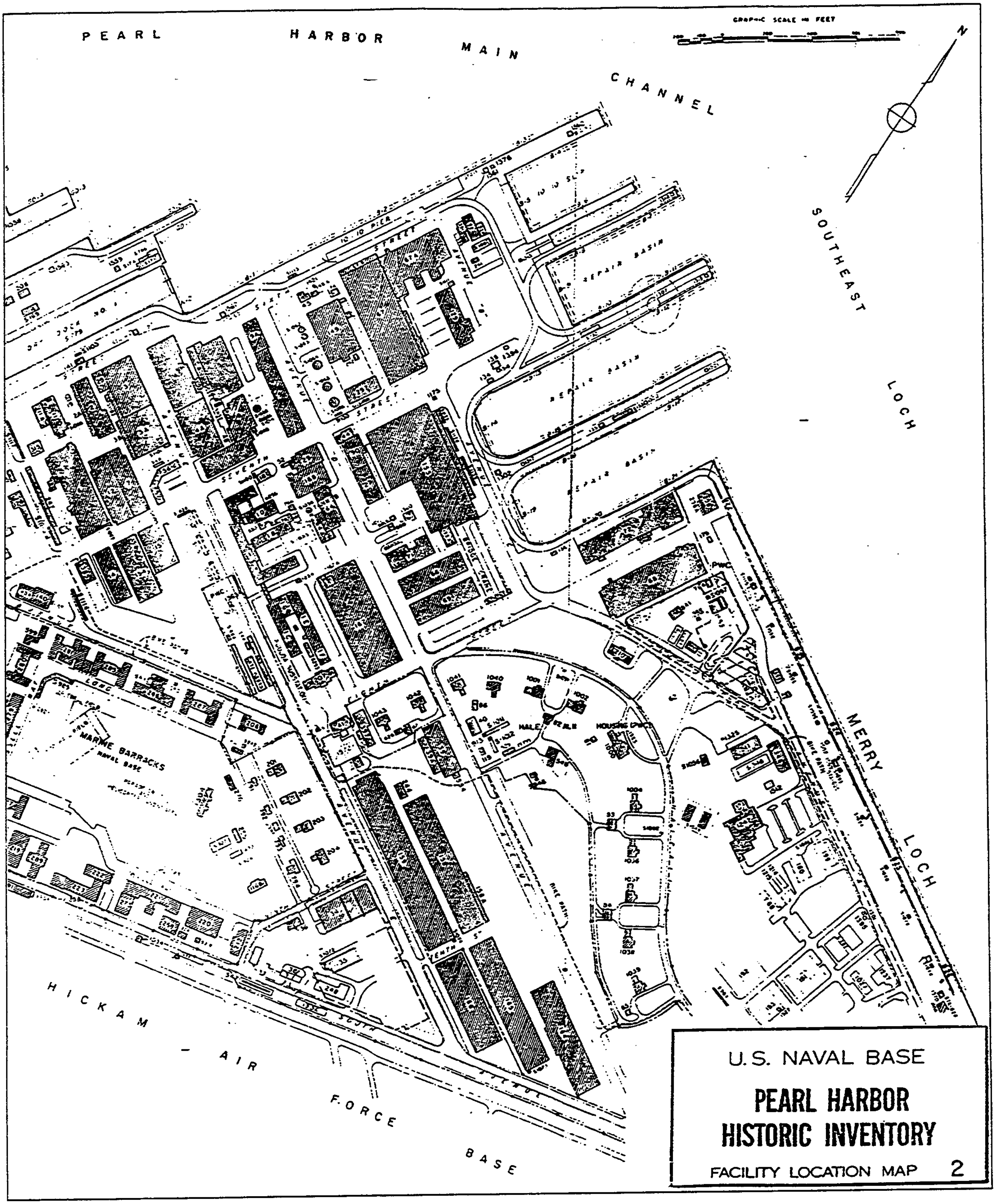

Figure 6.13-2. Historic Properties at the Proposed Project Area PHNSY (Page 2 of 2)

PEARL HARBOR HISTORIC INVENTORY
NAVAL SHIPYARD

CATEGORY 1

FACILITY NO.	CONSTR. DATE	ACT.	CURRENT USE	ORIG. CAT	SHPO RECAT	PROJ NO.	PROJ ACTION	LTR TO SHPO	LTR TO ACHP	FACILITY STATUS	PHOTOS TAKEN	LTR TO NPS	REMARKS
1	1913	SHYD	MULT	1	8/27/81								ADMIN BLDG
2	1911	SHYD	TRNG FAC							*			ELEC (AUTO) SHOP (ACHP 3/31/80)
3	1911	SHYD								DEMOLISHED			ELEC SHOP (ACHP 3/31/80)
6	1913	SHYD	MULT										FOUNDRY
7	1916	SHYD	SAME										WOODWORKING SHOP
12	1916	SHYD	WOODWRKG										BOAT SHOP
14	1916	SHYD	SAME										PATTERN SHOP
155	1941	SHYD	MULT										SHIPFITTING/WELDING SHOP
167	1942	SHYD	MULT										SUPPLY
214	1943	SHYD	MULT	2	12/30/80								ELECTRONIC WEAPONS SHOP
215	1943	SHYD	MULT	2	12/30/80								OUTSIDE MACHINE SHOP
1170	1942	SHYD	FOUNDRY	2	12/30/80								CRUSHER/PULVERIZER
1307	1935	SHYD								DEMOLISHED			HAMMERHEAD CRANE (ACHP 2/8/79)
S777	1943	SHYD			DEFERRED								MARINE RAILWAY *3 (12/11/81)
S779	1919	SHYD	SAME	1	12/11/81								DRY DOCK 1 *1

PEARL HARBOR HISTORIC INVENTORY
NAVAL SHIPYARD

CATEGORY 2

FACILITY NO.	CONSTR. DATE	ACT.	CURRENT USE	ORIG. CAT	SHPO RECAT	PROJ NO.	PROJ ACTION	LTR TO SHPO	LTR TO ACHP	FACILITY STATUS	PHOTOS TAKEN	LTR TO NPS	REMARKS
66	1923	SHYD	WHSE		DEFERRED								STORAGE (12/30/80)
69	1923	SHYD	MULT		DEFERRED								STORAGE (12/30/80)
71	1924	SHYD	MULT		DEFERRED								STORAGE (12/30/80)
178	1942	SHYD	PLNG OFFC							DEMOLISHED			BLDG. 1 BOMB SHELTER (ACHP 7/25/79)

PEARL HARBOR HISTORIC INVENTORY
NAVAL SHIPYARD

CATEGORY 3

FACILITY NO.	CONSTR. DATE	ACT.	CURRENT USE	ORIG. CAT	SHPO RECAT	PROJ NO.	PROJ ACTION	LTR TO SHPO	LTR TO ACHP	FACILITY STATUS	PHOTOS TAKEN	LTR TO NPS	REMARKS
11A	1938	SHYD											STORAGE
140-140A	1938	SHYD	SAME	2	10/6/80								MED CLINIC/SAFETY OFFICE
155A	1944	SHYD	SHOPS										STORAGE
1B	1941	SHYD	MULT	2	12/30/80								BLDG 1 ANNEXES [DEMOLISH ACHP 7/25/79]
1C	1941	SHYD	MULT	2	12/30/80								BLDG 1 ANNEXES
1D	1941	SHYD	MULT	2	12/30/80								BLDG 1 ANNEXES [DEMOLISH ACHP 7/25/79]
1E	1941	SHYD	MULT	2	12/30/80						2/90		BLDG 1 ANNEXES
1F	1941	SHYD	MULT	2	12/30/80								BLDG 1 ANNEXES
1G	1941	SHYD	MULT	2	12/30/80								BLDG 1 ANNEXES
1H	1941	SHYD	MULT	2	12/30/80								BLDG 1 ANNEXES
2A	1942	SHYD											STORAGE
371A	1936	SHYD	ADMIN OFF										ADMIN STGE
3A	1941	SHYD	PIPE SHOP	2	12/30/80					*			ELEC SHOP ANNEX (ACHP 3/13/80)
3B	1943	SHYD	SHIPS FRC										ELECTRIC SHOP
4A	1941	SHYD	CODE 3480	2	10/6/80								SHEET METAL SHOP
5A	1941	SHYD	SAME	2	12/30/80								GALVANIZING SHOP
64A	1943	SHYD	MULT										POST OFFICE
67A	1941	SHYD	MULT	2	12/11/81								INSIDE MACH SHOP
67B	1942	SHYD	MACH SHOP										ADMIN BLDG
79/79A	1925	SHYD											VACANT
817A	1942	SHYD											MAINT STGE
92A	1943	SHYD	SAME										DIVING LOCKER
B1	1927	SHYD	SAME										REPAIR WHARF
B3	1936	SHYD	SAME										REPAIR PIER/WHARF
B4	1936	SHYD	SAME										REPAIR PIER/WHARF
B5	1936	SHYD	SAME										REPAIR PIER/WHARF
B6	1936	SHYD	SAME										REPAIR PIER/WHARF
B7	1936	SHYD	SAME										REPAIR PIER/WHARF
B8	1936	SHYD	SAME										REPAIR PIER/WHARF
B9	1936	SHYD	SAME										REPAIR PIER/WHARF
B10	1936	SHYD	SAME										REPAIR PIER/WHARF

PEARL HARBOR HISTORIC INVENTORY
NAVAL SHIPYARD

CATEGORY 3

FACILITY NO.	CONSTR. DATE	ACT.	CURRENT USE	ORIG. CAT	SHPO RECAT	PROJ NO.	PROJ ACTION	LTR TO SHPO	LTR TO ACHP	FACILITY STATUS	PHOTOS TAKEN	LTR TO NPS	REMARKS
B11	1936	SHYD	SAME										REPAIR PIER/WHARF
B12	1936	SHYD	SAME										REPAIR PIER/WHARF
B13	1936	SHYD	SAME										REPAIR PIER/WHARF
B14	1936	SHYD	SAME										REPAIR PIER/WHARF
B15	1936	SHYD	SAME			P-441R	IMPROVE				1/90	D 5/18/90	REPAIR PIER/WHARF
B16	1936	SHYD	SAME			P-441R	IMPROVE				1/90	D 5/18/90	REPAIR PIER/WHARF
B17	1936	SHYD	SAME			P-441R	IMPROVE				1/90	D 5/18/90	REPAIR PIER/WHARF
B18	1936	SHYD	SAME			P-441R	IMPROVE				1/90	D 5/18/90	REPAIR PIER/WHARF
B19	1936	SHYD	SAME										REPAIR PIER/WHARF
B20	1936	SHYD	SAME										REPAIR PIER/WHARF
B21	1936	SHYD	SAME										REPAIR PIER/WHARF
B22	1937	SHYD											REPAIR WHARF
GD3	1944	SHYD	SAME										REPAIR WHARF
GD5	1944	SHYD	SAME										REPAIR WHARF
GD-1	1944	SHYD	SAME										REPAIR PIER
GD-2	1944	SHYD	SAME										REPAIR PIER
GD-4	1944	SHYD	SAME										REPAIR WHARF
N1-N2	1946	SHYD	SAME										REPAIR WHARF
0-1	1915	SHYD											REPAIR WHARF
0-2	1944	SHYD	SAME										REPAIR WHARF
S1059	1942	SHYD											HT FUEL TANK
S1133	1942	SHYD	FALLOUT S										BOMB SHELTER *12
S1134	1942	SHYD											BOMB SHELTER *12
S1135	1942	SHYD											BOMB SHELTER *12
S1161	1944	SHYD	SAME										WELDING SLAB
S17	1919	SHYD	MULT	1	12/30/80								DRY DOCK 1 PUMPHOUSE *1
S780	1942	SHYD	SAME	1	12/11/81								DRYDOCK 2 *2
S781	1942	SHYD	SAME	1	12/11/81								DRYDOCK 3
S782	1943	SHYD	SAME	1	12/11/81								DRY DOCK 4 *4
S786	1950	SHYD	SAME										PUMPHOUSE
T11	1944	SHYD	SAME										FIRE DEPT STGE

PEARL HARBOR HISTORIC INVENTORY
NAVAL SHIPYARD

CATEGORY 3

FACILITY NO.	CONSTR. DATE	ACT.	CURRENT USE	ORIG. CAT	SHPO RECAT	PROJ NO.	PROJ ACTION	LTR TO SHPO	LTR TO ACHP	FACILITY STATUS	PHOTOS TAKEN	LTR TO NPS	REMARKS
T15-T15A	1943	SHYD	STGE										SUB, SALVAGE GEAR
T29	1944	SHYD											STORE HOUSE
T44	1944	SHYD	SHOP										STORAGE *7
4	1913	SHYD	SAME	1	12/30/80								SHIPFITTING & BOILER SHOP
5	1913	SHYD	SAME	1	12/30/80	R94-86	ROOF REP			PENDING			FORGE & PROPELLER SHOP
8	1913	SHYD	MULT	1	12/30/80								ELEC POWER PLANT
9	1925	SHYD	MULT										STORAGE
11	1917	SHYD	MULT	1	12/30/80								PAINT SHOP
13	1917	SHYD	SAME	1	12/30/80								PIPEFITTING SHOPS
15	1916	SHYD	SAME	2	12/30/80								SHOP STORE
18	1916	SHYD	SAME										STORAGE
19	1918	SHYD	SAME										LATRINE
21	1919	SHYD											STORAGE
22	1918	SHYD											STORAGE & GARAGE *6
27	1919	SHYD	PAINT/OIL	2	12/30/80								MUNITIONS
26	1919	SHYD											STORAGE (ELEC SHOP)
29	1918	SHYD	SAME										SECURITY & DINING RMS
33	1919	SHYD	SAME										LATRINE
39	1943	SHYD	GEN WHSE	2	12/30/80								SUPPLY
44	1943	SHYD	REACTOR										ADMIN BLDG
58	1943	SHYD	MULT	2	12/30/80								TRANS, REPAIR SHOP
64	1923	SHYD	MULT	2	10/6/80								STORAGE & SUPPLY
67	1926	SHYD	MULT	1	12/30/80								INSIDE/OUTSIDE MACH SHOP
68	1923	SHYD	MULT	1	12/30/80								CENTRAL TOOL SHOP
72	1924	SHYD	MULT	1	12/30/80								SHEET METAL SHOP
74	1923	SHYD	SAME										LATRINE
90	1925	SHYD	MULT										FLAM STOREHOUSE
92	1926	SHYD	SAME	2	12/30/80								WELDING SCHOOL
97	1943	SHYD	GEN WHSE										STORAGE *7
128	1923	SHYD											STORAGE
129	1933	SHYD	SHOPS	2	12/30/80								STORAGE

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134	1936	SHYD	SAME										LATRINES *9
136	1935	SHYD	SAME										LATRINES *9
139	1937	SHYD	SAME										RIGGING GEAR STOREHOUSE
141	1937	SHYD	SAME										HEAD OR LATRINE
153	1939	SHYD											STORAGE & GARAGE *6
154	1942	SHYD		2	12/30/80								LUMBER MILL
157	1942	SHYD		2	10/6/80								RIGGER'S & LABORERS SHOP
158	1940	SHYD	SAME	2	12/30/80								STORAGE *5
159	1940	SHYD	SAME	2	12/30/80								STORAGE *5
164	1941	SHYD	SAME										GEN WHSE
165	1941	SHYD	SAME										GEN WHSE
168	1942	SHYD											CAFETERIA
170	1941	SHYD	MULT	1	12/30/80								DRYDOCK 2 *2
171	1941	SHYD	MULT										LATRINE
173	1942	SHYD	RIGGING										STORAGE REPAIR HOUSE
181	1942	SHYD		2	8/21/80								QUALITY ASSURANCE OFFICE
206	1942	SHYD	SAME										FIRE STATION
207	1942	SHYD	MULT										DISPENSARY
208	1941	SHYD	MULT										LATRINE *10
209	1941	SHYD	OFFICE										CAFETERIA *10
213	1942	SHYD	SAME										RADIATION HEALTH LAB
233	1943	SHYD	MULT	1	12/30/80								MARINE RAILWAY *3
247	1943	SHYD	SAME										FOUNDRY STORAGE BLDG
296	1942	SHYD	STGE										PIPE SHOP ANNEX
298	1943	SHYD											DRY DOCK MAINTENANCE
299	1944	SHYD		2	12/30/80								WELDING ANALYSIS SHOP (FORMER CAT 2 SHPO 10/6
315	1944	SHYD	OFFICE	2	12/30/80								X-RAY LAB
324	1921	SHYD	MULT										ADMIN
327	1925	SHYD	SAME										RPIO OFFICE
370	1938	SHYD	SHIPS FRC										ADMIN STGE
385	1944	SHYD	STGE										SHOP STORES

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CATEGORY 3

FACILITY NO.	CONSTR. DATE	ACT.	CURRENT USE	ORIG. CAT	SHPO RECAT	PROJ NO.	PROJ ACTION	LTR TO SHPO	LTR TO ACHP	FACILITY STATUS	PHOTOS TAKEN	LTR TO NPS	REMARKS
387	1941	SHYD	SAME										LATRINE
388	1944	SHYD	SAME	2	10/6/80								SHIPYARD REPAIR SHOP
391	1942	SHYD	SAME										WELDING TRAINING
392	1942	SHYD	SAME										WELDING TRAINING
393	1945	SHYD	MULT	2	12/30/80								WAREHOUSE
394	1945	SHYD	MULT	2	12/30/80								WAREHOUSE & BATTERY SHOP
398	1943	SHYD	SAME	1	12/30/80								DRY DOCK 4 *4
399	1943	SHYD	SAME	1	12/30/80								DRY DOCK 4 *4
536	1942	SHYD											FLAM STOREHOUSE
823	1945	SHYD	RIGGING										CHAIN FALL TEST/REPAIR
824	1946	SHYD											STORAGE *11
825		SHYD											STORAGE *11
826		SHYD											STORAGE
1236	1946	SHYD	SAME	1	12/30/80								BRIDGE CRANE WAY

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CATEGORY 4

FACILITY NO.	CONSTR. DATE	ACT.	CURRENT USE	ORIG. CAT	SHPO RECAT	PROJ NO.	PROJ ACTION	LTR TO SHPO	LTR TO ACHP	FACILITY STATUS	PHOTOS TAKEN	LTR TO NPS	REMARKS
S846	1944	SHYD	PARKING										BIKE SHELTER
S1013	1942	SHYD											BOMB SHELTER
S1014	1942	SHYD											BOMB SHELTER
S1062	1942	SHYD											TANK
S1063	1942	SHYD											TANK
S1064	1942	SHYD											TANK
S1065	1953	SHYD											TANK
S1066	1953	SHYD											TANK
S1067	1942	SHYD											BOMB SHELTER & GARAGE
S1115	1942	SHYD	FALLOUT S										BOMB SHELTER
S1117	1942	SHYD											BOMB SHELTER
S1118	1942	SHYD											BOMB SHELTER
S1119	1942	SHYD											BOMB SHELTER
S1120	1942	SHYD											BOMB SHELTER
S1130	1942	SHYD											BOMB SHELTER
S1131	1942	SHYD											BOMB SHELTER
S1132	1942	SHYD											BOMB SHELTER
S1153	1942	SHYD											BOMB SHELTER
S1159	1942	SHYD											OLD QUALITY ASSURANCE
880	1948	SHYD	OXY STGE										FLAM STOREHOUSE
1019	1954	SHYD	SAME										STORAGE
1229	1944	SHYD	SAME										PUMP HOUSE DRYDOCK #3
1235	1947	SHYD											TRANSDUCER PIT

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CATEGORY 5

FACILITY NO.	CONSTR. DATE	ACT.	CURRENT USE	ORIG. CAT	SHPO RECAT	PROJ NO.	PROJ ACTION	LTR TO SHPO	LTR TO ACHP	FACILITY STATUS	PHOTOS TAKEN	LTR TO NPS	REMARKS
B2	1966	SHYD	SAME										REPAIR WHARF
9A	1953	SHYD	NUCLR REP										RADAR ANTENNA REPAIR
1175	1957	SHYD	SAME										BUS STOP
1176	1957	SHYD	SAME										PASSENGER PLATFORM
1233	1960	SHYD	SAME										TRANSDUCER TEST SITE
1234	1960	SHYD											TRANSDUCER TEST SITE
1254	1961	SHYD	SAME										CARPORT
1274	1963	SHYD	SAME										NUCLEAR WASTE FAC
1291	1964	SHYD											OUTHOUSE
1302	1965	SHYD	SAME										SNACK BAR
1360	1970	SHYD	SAME										PAINT SHOP
1361	1970	SHYD	SAME										SAND BLAST
1365	1970	SHYD	SAME										TRANSDUCER TANK
1372	1969	SHYD	SAME										DISTILLED WATER TANK
1373	1969	SHYD	SAME										BATTERY WASHHOUSE
1374	1969	SHYD											ELECTROLYTER WATER TANK
1375	1969	SHYD	SAME										ACID TOPPING TANK
1384	1972	SHYD	SAME										NUCLEAR WASTE FAC
1409	1971	SHYD	SAME										NUCLEAR WASTE FAC
1417	1973	SHYD	WASTE PLT										LATRINE
1419	1973	SHYD											SNACK BAR
1420	1976	SHYD	SAME										SAND BLAST
1421	1975	SHYD	SAME										SNACK SHOP